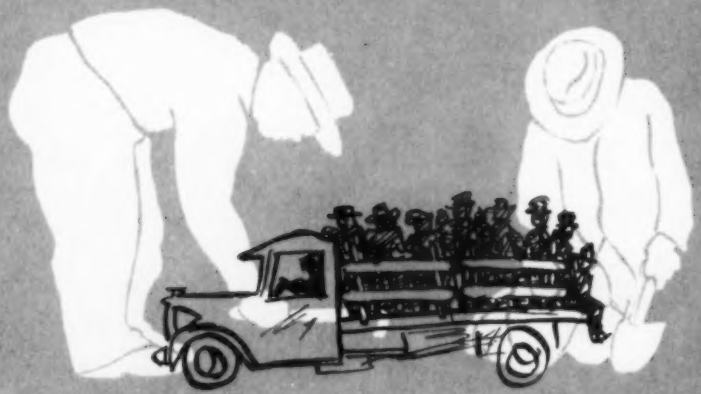
# PUBLIC HEALTH REPORTS

*In this issue*

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

# the Migratory Farm Worker



# PUBLIC HEALTH REPORTS

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## frontispiece

**All of us have a responsibility for helping the migrant farm worker and his family share in community services, including health services (see paper on pages 471–477).**

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PUBLIC HEALTH REPORTS





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U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
MARION B. FOLSOM, *Secretary*

PUBLIC HEALTH SERVICE
LEROY E. BURNEY, *Surgeon General*

# The Migrant and the Rest of Us

OTIS L. ANDERSON, M.D.

PUBLIC HEALTH workers, private physicians, and other local community residents are likely to have varied impressions of migrants depending on the angle from which they are viewed. The sanitarian sees the crowded housing of migrants with its lack of proper provision for sewage and garbage disposal and its water supply that may be polluted. The public health nurse who visits labor camps as part of her routine at the peak of the crop season sees cases of diarrhea, impetigo, malnutrition, and ear infections. The local physician and the hospital administrator see only people who come in an emergency when a serious accident or illness makes them seek medical care. Migrants may have few resources of their own for meeting an emergency. Nonresidence makes them ineligible for local welfare aid, and so some of their bills remain unpaid at the end of every crop season. The average person in a community is likely to view the migrant worker as a necessary part of the local economy, but potentially an economic burden if he stays beyond the season when he is needed. This same average person may fear the migrant as a potential disease carrier.

Only by putting all these views together can the migrant health problem be seen in its totality. For the Nation, the exact dimensions of the problem are poorly defined. Twenty years ago a national health survey showed more frequent illness and longer-term disability among individuals and families on the move than among permanent residents. There is little evidence that the relative health status of the two groups has changed greatly in the last 20 years. Diarrheal disease continues to be common among migrant children. Outbreaks of typhoid and diphtheria continue to occur sporadically in migrant camps. All indications are that migrant children are probably less likely to be immunized against preventable diseases than resident children. Too often mothers fail to obtain prenatal care that will help to assure the health of both mother and child. Poor diets are common.

*Dr. Anderson, Assistant Surgeon General of the Public Health Service, is chief of the Bureau of State Services.* *This paper is based on an address at the Friday morning session of the Twelfth National Conference on Rural Health in Louisville, Ky., March 8, 1957. The conference was sponsored by the Council on Rural Health of the American Medical Association.*

## Number of People Involved

The national estimate of the number of migrants is approximately 1.25 million. Of these, nearly one-half million are foreign workers, chiefly from Mexico. These aliens are single men working under contract, with guarantees of work for stipulated periods of time. They are physically screened before they enter the country. Health insurance protection is given them under the terms of their contract. Housing for them must meet minimum requirements before they are assigned to an employer. When their contracts are fulfilled, the workers return to their own countries.

The tightening of our border patrol has nearly eliminated the wetbacks, illegal entrants, who formerly crossed the Mexican border in droves at harvest time.

**Many workers are accompanied by family dependents.**

The remaining three-fourths of a million in the agricultural migrant population are workers and their dependents who come chiefly from the southern border States. Texas is the largest single supply State and the greatest demand State. Unlike the foreign workers with contracts, these domestic agricultural workers, who are United States citizens, seldom work under contract. Few have health insurance protection, and standards for their housing are likely to be minimal.

While the domestic migrant works in sugar beets, cherries, potatoes, cotton, or beans, his pay may be relatively good. But periods of employment are balanced by periods of unemployment when the weather is bad, crops are poor, or work not available between crop seasons. Working time is also lost when workers are traveling from job to job. Most domestic migrant families lead a hand-to-mouth existence with an annual income of not more than $2,000 even when several members of the family work. The average cash income of the male migratory farm worker, according to a 1954 national sample survey, was $1,160. This includes income from both farm and nonfarm sources.

### Economic Background

Seasonal work in agriculture requires a mobile labor force. As American agriculture has become bigger and more industrialized, machines have reduced the total number of man-hours of work required to produce the Nation's food and fiber. But some operations have not yet been mechanized nor for them does mechanization appear to be possible. Thus, for the greater part of a year, a relatively small labor force may be able to carry on the work of many crop areas. For a few short weeks or months, however, this labor force must be greatly expanded or the rest of the year's work will be lost. Some local workers can be recruited for short periods, but in many areas, the local labor supply must be supplemented by outside workers.

Available work changes with the seasons.

**Family "housing" in a makeshift camp.**

In the early spring the vegetable pickers are stooping over the fields in Florida, the Lower Rio Grande Valley, and southern Arizona and California picking the fresh carrots, beans, spinach, peas, celery, and lettuce that we serve on our dinner tables. These workers are chiefly southern Negroes, Puerto Ricans, Indians of the southwest, Spanish-Americans, including both domestic workers and Mexican nationals, and Anglo-Saxons from low-income farming areas in the south.

By the middle of the summer some of these same people are doing the same kind of work in New York State, Michigan, Montana, Colorado, Idaho, Washington, Oregon, and other northern States. At the end of the crop season, they will head south again in trucks, buses, and cars.

### Impact on Local Health Resources

As stated earlier, the total number of domestic migrants is estimated at about three quarters of a million. A map of their movement, however, makes it clear that this figure is not a true measure of the size of the problem (*1*). It has been said that the number might well be multiplied by the number of times people move. In each new location housing must be available. Local health workers must be ready to provide services if the health of both migrant and resident population is to be protected. Other community services must be stretched to accommodate the strangers.

The number of migrants of greatest importance in planning health services is not the national total, but the number in a particular locality at a particular time. All but two States have at least a few migrants for at least a short time. In many States, however, the area requiring farm workers from outside is exceedingly restricted. Of the total of 3,068 counties in the Nation, about 800 are estimated to have as many as 100 or more domestic migrant workers and family dependents at the peak of the season. Only about 75 counties have more than 3,000. Twenty-two of these counties, however, have more than 10,000 migrants at


**A health center operated by a voluntary group in a labor camp.**

the peak. The peak period may last for only a few weeks or for several months.

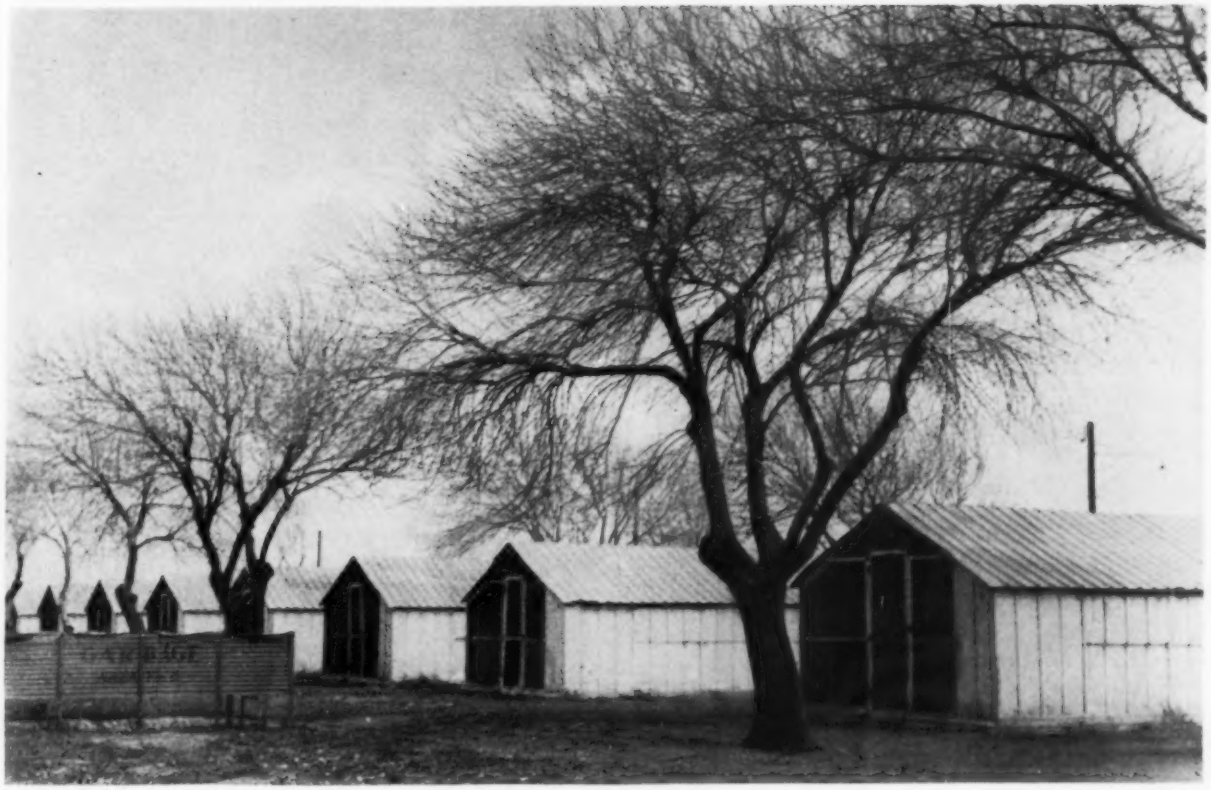
The impact of migrants on a county varies according to the size of the resident population and the availability of health resources. A county with 100,000 people may be fairly well equipped to care for the health needs of its permanent residents. Stretching these services to meet the needs of a few thousand temporary residents may require special planning but may not interrupt the usual routine very drastically. If, on the other hand, 10,000 or more migrants flock into an area whose resident population is no more than a few thousand, the health problems confronting local physicians and public health workers may be doubled overnight. Migrant work areas are predominantly rural, and many have a shortage of local health resources even for permanent residents.

### Federal vs. Local Responsibility

The interstate aspects of the problem become clear from a look at the main routes migrants travel. On the east coast, about 50,000 migrants start in the south in the spring and move back in the fall. From south Texas, at least 100,000 fan out to other parts of Texas and to the North Central, Mountain, and Pacific Coast States. Another 80,000 or 90,000 move within California and to adjacent States.

Because of this interstate movement, some people have looked at migrant health as an interstate problem, one that might properly come under the jurisdiction of the Federal Government. On this basis, the Federal Government undertook the organization and financing of the agricultural workers' health associations during World War II. Local physicians and public health agencies worked through these associations with the Federal Government in providing services in major work areas along each of the main migrant routes. The major part of the financing came from the Federal Government. Federal funds were discontinued after 1947.

Today, pressures continue to be brought upon the Federal Government for financing



**Well-maintained family units in a large labor camp.**

migrant health care on the basis that the migrants are nonresidents and, therefore, not the responsibility of the State or local area where they work and live temporarily. On the other hand, some people are beginning to look upon migrants as part of the permanent population of an area even though they live there for only part of the year.

### Local Efforts to Assume Responsibility

The view that migrant farm workers and their families are a permanent and essential part of the local economy is leading some localities to try to provide for them accordingly. Generally, these localities find that providing better housing, encouraging migrant children to go to school, and arranging for health services pay off in terms of greater assurance of dependable workers when they are needed and reduce chances of disease arising and spreading among both migrants and local residents.

Partnership between local medical societies and public health workers has been arranged in Fort Lupton, Colo., Fresno County, Calif., and a few other areas. Local physicians and public health nurses have teamed up in staffing clinics held during workers' off-hours. These clinics provide services to prevent and control the spread of communicable disease. They also provide medical care for people who need it. They have been set up in places and at times convenient for the workers, many of whom do not have their own transportation and cannot well afford to lose time from work to bring their children in for immunization or to get treatment for sickness or injury.

Arrangements such as these are born of a need mutually recognized by local physicians, local public health workers, and other local residents. These workers, assisted by volunteers, have community support behind them. But even under the best circumstances many problems arise. With the best of planning, a newly opened clinic may attract only a handful of patients at first. Some of the first patients may be more curious than in need of care. Considerable patience is required. Public health

nurses may need to visit migrant families and encourage them to come to the clinic before there is any great demand for service. Once understanding and acceptance of the service have developed, however, the demand may well test the endurance of the staff.

### One Clinic's Operation

A look might be taken into a clinic that has operated for about 5 years in a large labor camp in a building provided by the employer. On a typical day the clinic starts in the early evening. There are only a few patients at first, but more and more come until the small building is jammed. Some people have had to arrange with others for transportation. Many bring small children. There are 60 patients, but at least twice as many people are waiting.

A volunteer from a local women's organization takes down essential information at the reception desk. In a small room at one side, a public health nurse advises mothers on the care of their small children. In another room a physician from the local medical society, assisted by two public health nurses, is examining and treating a steady flow of patients. The local welfare agency pays each of the six physicians who serve on a rotating basis a set fee for each clinic session he conducts.

The cases seen include a child with a lacerated foot, a suspected case of tuberculosis referred to the county hospital for X-ray, a case of venereal disease, a sprained arm, several pregnant women, and two members of a family referred to the clinic because another family member has recently been hospitalized for typhoid fever.

A class in home nursing is conducted by a Red Cross volunteer in a small back room. Here, and in the waiting room, people seem to welcome the chance for sociability.

By agreement among the local medical society and other local agencies, the small fee that is supposed to be charged each patient is often waived. This is especially true when opportunity for work has been scarce in recent months and the families living in migrant camps have little or no money. Under such circumstances, local people believe that asking even a small fee will discourage people from coming for needed care and defeat the purpose of the clinic.

### Variation in Local Projects

The situation varies widely from place to place. Local needs differ and local resources for meeting these needs likewise differ. The migrant population group itself varies from one place to another, and these variations require different approaches if needs are to be served. Differences in language present an obvious problem when the Spanish-speaking migrant comes to a local physician or to a public health clinic in northern Michigan or Wisconsin. Differences in health beliefs and practices may be equally baffling to the physician or nurse who is trying to explain to a migrant mother how to care for her children.

Often there will be a need for supplementing local health resources when the migrant influx is at a peak. Some communities have found inactive local nurses who are willing to help in a migrant project. Physicians from nearby towns have participated in clinics set up in or near migrant camps. The Home Missions Division of the National Council of Churches, the Catholic Charities, women's organizations, and other groups have provided volunteer assistance in clinics, transportation and interpretation to migrants, and interpretation to communities at large of what a clinic was trying to do. Also they have financed services for individuals, and provided direct financial support for clinic operation. Employers and their associations may furnish a building for a clinic, assist in financing, or lend support in other ways. Farmers' wives and their organizations are still another source of interest, support, and active participation on a voluntary basis.

### Role of Federal Agencies

Although local projects necessarily vary according to the local situation, they are likely to have certain needs in common. For example, a need that is repeatedly voiced by local physicians and public health workers is for some method of assuring continuity in the services provided as people move from place to place. Questions of how to finance health services

through voluntary health insurance and other means also frequently arise.

Other problems that confront most communities when they become interested in trying to meet migrants' health problems include adapting health services to population groups that differ markedly from the resident population in personal characteristics and in living and working conditions; developing community understanding of migrant problems; and encouraging community support in meeting them.

The major role of the Public Health Service is one of consultation and technical assistance to State and local groups in meeting these problems. Both the Public Health Service and the Children's Bureau have assisted in planning experiments with health records to be carried by migrant families. Although we do not feel that the experiments thus far have provided definitive answers to the problem of providing continuity of health services as migrants move, we have learned much that can be applied in a future study of this problem.

Another role, chiefly informational, has been passing on to new areas the ideas and plans that other communities have found successful. The Public Health Service has served from time to time as a catalyst to bring together individuals and groups concerned with specific health problems associated with the migration of agricultural workers and their families.

The philosophy in terms of the long-run interests of both the domestic migrant and the community, including the Nation as a community, is that migrants need to be viewed as an integral part of the general population. They form an essential part of our human resources. Their problems arise to a considerable extent from a mobility that is required by our agricultural economy in its present stage of development.

Special services may be required at times to meet emergency conditions. Generally, however, it seems desirable to meet the needs of migrants through the framework of existing community services for other citizens, with such modifications as may be necessary to meet the migrant's peculiar working and living conditions.

### "The Rest of Us"

Certainly the whole Nation profits by migrant labor. Much of the food that reaches our family tables is harvested and processed by migrant workers. The communities where migrants work and live temporarily profit most of all. Sometimes local people say, "We have no responsibility for migrants. They don't pay taxes." Some of these same people might find it difficult to pay their own taxes if migrants failed to appear at the critical times in crop production and harvesting.

All of us have a responsibility for understanding the important contribution the agricultural migrant makes to our economy. We have a further responsibility for helping him and members of his family share in community services on a continuing basis, including health services. The Public Health Service is sincerely interested in helping to identify the health problems both of the person who is on the move and of the communities to which he returns for a short time each year and to plan for meeting these problems.

### REFERENCE

(1) Leone, L. P., and Johnston, H. L.: Agricultural migrants and public health. Pub. Health Rep. 69: 1–8 (p. 5), January 1954.

# use of general hospitals

# Factors in Outpatient Visits

MAURICE E. ODOROFF, M.A.
LESLIE MORGAN ABBE, B.S.

AS PART of a study of the use of general hospitals, the level of use of outpatient facilities in relation to various personal, geographic, and economic factors has been investigated. Data were obtained through interviews of about 27,000 households, including about 90,000 persons of all ages, drawn from the civilian, noninstitutional population of every State in the United States. Selected highlights of the findings on outpatient visits are reported here as advance information.

In the course of each interview, the respondent was asked whether anyone in the household had received care in any hospital without staying overnight, "for example, in a hospital clinic, emergency room, outpatient department, etc." For each person identified as having received outpatient care, the name and location of hospitals visited and the number of visits made for outpatient care during the previous 12 months were recorded. Personal characteristics of each member of the household and the income level of each household were also learned. In tabulating results, particular attention was given to determining the place of care with respect to the type of place of residence (metropolitan, urban, or rural) of the patient.

The survey findings are limited by the exclusion of institutional populations, the absence of data on hospital use by persons who died, emigrated, or entered the armed services before the survey date, and the normal variability of sampling. In addition, note should be made of the possibility of errors in response with respect to the data on outpatient visits. The frequency of outpatient visits may not be remembered as completely as the frequency and extent of inpatient care. Earlier experience in health surveys indicates a considerable loss of recall when the period of time elapsed between the occurrence and the reporting is extensive, unless the event was important in itself to the person interviewed or was associated with significant points in time or other distinguishing factors (*1*, *2*). In this survey differentials in use are more important than definitive levels of use. Accordingly, while under-reporting may affect the general level of use, it is considered of minor consequence.

Two basic measures have been selected to

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This paper is the second interim report setting forth provisional findings of a national household survey of the use of general hospitals. The first, published in the May 1957 issue of Public Health Reports (pp. 397–403), briefly described the survey procedure and presented findings on demographic and ecologic factors in the use of inpatient facilities. Analysis and interpretation of the data will be included in a summary monograph when the study is completed.

The survey is considered a first step in defining more precisely appropriate standards of need for general hospitals in the light of changing medical practice and changing patterns of care. It is expected to point the way to more intensive studies of the real need for physical facilities for adequate care of a known and described population. The survey was conducted for the Division of Hospital and Medical Facilities of the Public Health Service in September 1956 by the Bureau of the Census in connection with its monthly current population survey.

describe the level of outpatient visits in varying circumstances. These are the number of outpatients receiving care annually per 1,000 population and the number of outpatient visits annually per 1,000 population. The volume of outpatient care reflected by these measures is set forth in comparison with three types of factors. One group of factors, relating to personal characteristics, may be considered demographic factors. Another group relates to the nature of the geographic and social setting of the place of residence and the place of care. In this study, these are called ecologic factors. A third factor is family or individual income.

### Demographic Factors

*Sex and race* have very little effect on the number of outpatients cared for, but they do affect greatly the number of outpatient visits (table 1).

Outpatient visits of white persons number 151 annually per 1,000 population, while visits of nonwhite persons amount to 238 per 1,000 population. For the nonwhite population, similar contrasts appear between men and women; nonwhite males report 188 visits, while nonwhite females report 285 visits. In the white population, only small differentials appear between visits of men and women.

*Age* affects the number of outpatients only slightly, except that a higher rate is found for children, but total outpatient visits rise substantially with age (table 2).

For children under 14 years of age, the number of outpatients, 58 per 1,000 population, is well above that of other age groups and the average (47) for all ages.

The number of outpatient visits is highest for the age groups above 45 years. The maximum is 251 visits for the age group 55–64 years, as compared with 161 visits for all ages and 98 visits for adolescents and young adults (ages 14–24 years).

**Table 1. Outpatient care in general hospitals, by sex and race**

| Sex and race | Annual number of outpatients per 1,000 population | Annual outpatient visits per 1,000 population |
|---|---|---|
| Both sexes | 47 | 161 |
| White | 47 | 151 |
| Nonwhite | 45 | 238 |
| Male | 47 | 151 |
| White | 48 | 146 |
| Nonwhite | 43 | 188 |
| Female | 47 | 170 |
| White | 47 | 156 |
| Nonwhite | 48 | 285 |

**Table 2. Outpatient care in general hospitals, by age**

| Age groups, in years | Annual number of outpatients per 1,000 population | Annual outpatient visits per 1,000 population |
|---|---|---|
| All ages | 47 | 161 |
| Under 14 | 58 | 136 |
| 14–24 | 43 | 98 |
| 25–34 | 42 | 169 |
| 35–44 | 40 | 153 |
| 45–54 | 43 | 204 |
| 55–64 | 45 | 251 |
| 65 and over | 41 | 193 |

*Veteran status* has minor effect on the number of outpatients cared for, but considerable effect on total outpatient visits (table 3).

Veterans of World War II report 188 outpatient visits annually, as compared with 109 visits for other veterans and 141 visits for nonveterans, among all males 14 years old and over.

**Table 3. Outpatient care in general hospitals for males 14 years old and over, by veteran status**

| Veteran status | Annual number of outpatients per 1,000 population | Annual outpatient visits per 1,000 population |
|---|---|---|
| All males 14 years old and over | 41 | 148 |
| Veterans | 38 | 161 |
| World War II veterans | 41 | 188 |
| Other veterans | 32 | 109 |
| Nonveterans | 43 | 141 |

**Table 4. Outpatient care in general hospitals for persons 14 years old and over, by employment status and industry**

| Employment status and industry | Annual number of outpatients per 1,000 population | Annual outpatient visits per 1,000 population |
|---|---|---|
| All persons 14 years old and over | 42 | 171 |
| In labor force | 39 | 126 |
| Employed | 39 | 123 |
| Agriculture | 32 | 83 |
| Nonagricultural industries | 39 | 128 |
| Wage and salary workers | 40 | 130 |
| Mining [1] | 66 | 173 |
| Construction | 42 | 115 |
| Manufacturing | 39 | 125 |
| Transportation, etc | 33 | 116 |
| Trades | 38 | 109 |
| Services | 41 | 152 |
| Professional | 42 | 132 |
| Other services | 41 | 167 |
| Public administration | 50 | 157 |
| Self-employed workers | 34 | 108 |
| Unpaid family workers | 38 | 151 |
| Unemployed workers | 56 | 222 |
| Not in labor force | 47 | 235 |
| Keeping house | 47 | 231 |
| Going to school | 38 | 87 |
| Unable to work | 67 | 822 |
| Other nonworkers | 48 | 249 |

[1] Includes forestry and fisheries.

*Employment status and industry* are accompanied by substantial differences both in the number of outpatients and in total outpatient visits (table 4).

For all persons 14 years of age and over, the number of outpatients cared for annually is 42 per 1,000 population. Within the labor force the number ranges from 32 for those employed in agriculture to 66 for wage and salary workers in mining (including forestry and fisheries). A similar high rate of 67 patients per 1,000 population is reported for persons unable to work because of a long-term illness or disability.

Total outpatient visits vary even more widely. The average rate for all persons employed is 123 visits annually per 1,000 population. Persons in agriculture report only 83 visits per 1,000 population, with a maximum among employed persons of 173 visits for wage and salary workers in mining. Unemployed workers and persons keeping house report a rate of visits of 222 and 231 per 1,000

**Table 5. Outpatient care in general hospitals, by region and type of residence**

| Region | Type of residence | | |
|---|---|---|---|
| | All types | Urban | Rural |
| | Annual number of outpatients per 1,000 population | | |
| All regions | 47 | 49 | 44 |
| Northeast | 46 | 50 | 38 |
| North Central | 45 | 50 | 36 |
| South | 48 | 48 | 49 |
| West | 49 | 44 | 58 |
| | Annual outpatient visits per 1,000 population | | |
| All regions | 161 | 179 | 132 |
| Northeast | 195 | 234 | 81 |
| North Central | 121 | 147 | 82 |
| South | 157 | 137 | 177 |
| West | 190 | 200 | 172 |

**Table 6. Annual outpatient visits in general hospitals per 1,000 population, by residence and place of care**

| Residence | Place of care | | | | | | |
|---|---|---|---|---|---|---|---|
| | All places | Standard metropolitan areas [1] | | | Urban (nonmetropolitan) | | Rural |
| | | Metropolitan area of residence | | Other metropolitan areas | Places 10,000–50,000 | Places under 10,000 | |
| | | Central city | Outside central city | | | | |
| All areas | 161 | ---- | ---- | 9 | 20 | 14 | 18 |
| Metropolitan areas | 179 | 148 | 24 | 4 | 2 | 1 | 1 |
| Central city | 232 | 222 | 3 | 5 | 1 | 2 | (2) |
| Urban fringe | 143 | 86 | 48 | 4 | 4 | (2) | 2 |
| Rural nonfarm | 104 | 56 | 44 | 3 | 1 | 1 | (2) |
| Rural farm | 69 | 47 | 12 | 1 | 10 | (2) | (2) |
| Urban (nonmetropolitan) | 123 | ---- | ---- | 23 | 62 | 32 | 6 |
| Places 10,000–50,000 | 133 | ---- | ---- | 30 | 98 | 5 | 1 |
| Places under 10,000 | 112 | ---- | ---- | 15 | 19 | 65 | 12 |
| Rural (nonmetropolitan) | 145 | ---- | ---- | 17 | 35 | 31 | 62 |
| Nonfarm | 144 | ---- | ---- | 19 | 41 | 27 | 57 |
| Farm | 146 | ---- | ---- | 15 | 25 | 37 | 69 |

[1] Includes a central city of at least 50,000 population with contiguous counties socially and economically integrated therewith, as defined by the Bureau of the Census.
[2] Less than 0.5.

population. Persons unable to work report an annual rate of 822 outpatient visits, an average of slightly more than 1 visit per month per person in this group receiving care.

### Ecologic Factors

*Geographic region and type of residence* have a limited effect on the number of outpatients but a very substantial effect on the number of outpatient visits (table 5).

The number of outpatients among persons who live in rural areas is low in the Northeast and North Central regions of the country (38 and 36 annually per 1,000 population), but is well above national averages in the South and West (49 and 58 annually per 1,000 population).

These differentials apply also to total outpatient visits of rural people. On the other hand, urban residents in the Northeast and West have a comparatively high number of outpatient visits annually (234 and 200 per 1,000 population). Rates are well below the national average for urban persons in the North Central region and in the South (147 and 137 visits annually per 1,000 population).

*Type of residence and place of care*, as they reflect accessibility, materially affect the level of outpatient visits (table 6).

The annual rate of outpatient visits from all types of residence in all places of care is 161 per 1,000 population.

Persons living in the central city of metropolitan areas report a rate of 232 visits. Outpatient visits drop to 143 for urban fringe residents and reach a low of 69 for persons from farms in the outer limits of metropolitan areas.

Outpatient visits by persons living in cities of 10,000–50,000 population not in metropolitan areas are reported at 133, while visits by persons living in nonmetropolitan rural areas are reported at 145 per 1,000 population.

Residents of the urban fringe of metropolitan areas make about three-fifths of their

total outpatient visits within the central city of the metropolitan area in which they live. Urban and rural residents of nonmetropolitan areas obtain the major portion of their outpatient care in their home communities, although from 10 to 20 percent of such care is obtained in metropolitan areas.

### Economic Factor

*Income and family status* have a substantial relation to the level of outpatient care received, at least with respect to the number of visits (table 7).

Among members of primary families, that is, persons related by blood, marriage, or adoption to the head of the household in which they live (*3*), the maximum number of outpatient visits is made by persons in the lowest income groups. The rate for all members of primary families decreases from 199 visits per 1,000 population for income groups under $1,000 to 106 visits for the income range $5,000–$10,000. Families with incomes over $10,000 are reported at an increased rate of 144 visits.

Children under 14 years of age in the lowest income group (under $1,000) have a very low rate of visits (59 per 1,000 population), although adults in families in this income group

**Table 7. Outpatient care in general hospitals, by income, family status, and age**

| Income [1] | Family status [2] and age | | | |
|---|---|---|---|---|
| | Members of primary families | | | Primary individuals |
| | All members | Members 14 years and over | Members under 14 years | |
| | Annual number of outpatients per 1,000 population | | | |
| All incomes | 46 | 42 | 57 | 60 |
| Under $1,000 | 41 | 46 | 27 | 81 |
| $1,000–$1,999 | 49 | 47 | 53 | 65 |
| $2,000–$2,999 | 50 | 47 | 56 | 45 |
| $3,000–$3,999 | 49 | 43 | 62 | 42 |
| $4,000–$4,999 | 48 | 42 | 60 | 35 |
| $5,000–$7,499 | 45 | 37 | 61 | 51 |
| $7,500–$9,999 | 46 | 41 | 61 | |
| $10,000 and over | 44 | 43 | 48 | |
| Income not reported | 34 | 29 | 52 | 26 |
| | Annual outpatient visits per 1,000 population | | | |
| All incomes | 151 | 160 | 128 | 328 |
| Under $1,000 | 199 | 256 | 59 | 545 |
| $1,000–$1,999 | 197 | 202 | 185 | 395 |
| $2,000–$2,999 | 194 | 211 | 156 | 183 |
| $3,000–$3,999 | 146 | 139 | 159 | 152 |
| $4,000–$4,999 | 177 | 200 | 133 | 144 |
| $5,000–$7,499 | 106 | 102 | 114 | 89 |
| $7,500–$9,999 | 105 | 110 | 90 | |
| $10,000 and over | 144 | 167 | 68 | |
| Income not reported | 119 | 126 | 97 | 47 |

[1] For members of primary families, "income" includes money income of all members of the family; for primary individuals, it includes personal income only.

[2] Primary family members include persons related by blood, marriage, or adoption (one of these persons being the head of the household). Primary individuals are heads of households not living with relatives (see reference 3).

report a level more than 4 times as great. Except for this lowest income group, the data reported for primary families show rather close parallels for annual outpatient visits by children and adults.

Primary individuals, that is, heads of households not living with relatives (*3*), with incomes under $2,000 report a rate of outpatient visits greatly in excess of the outpatient visits made by adults in primary families with similar incomes. The rate reported among primary individuals in the income group under $1,000 is 545 visits per 1,000 population; among those in the group $1,000–$1,999, it is 395 visits per 1,000 population.


## Summary

This is the second interim report on a national household survey of the use of general hospitals by a known population. Data have been compiled from a sample comprised of about 27,000 families, including about 90,000 persons of all ages. This report records provisional findings on factors related to the level of outpatient visits to general hospitals. These factors include demographic, ecologic, and economic aspects.

The most significant contrasts in level of outpatient use appear for variations in income levels. Families with incomes below $2,000 are reported as making about 200 outpatient visits annually per 1,000 population, while those with incomes between $5,000 and $10,000 report about one-half of this rate. Primary individuals (household heads not living with relatives) in the income groups below $2,000 report outpatient visits at a level double that of adults in primary families with the same income.

Substantial differences in the rate of outpatient visits accompany variations in race, sex, age, and employment status. Place of residence appears also to have a considerable effect on the rate of outpatient visits. The rate is highest for residents of the central city in metropolitan areas and lowest for the rural farm population in metropolitan areas. The rate of outpatient visits for the farm population outside metropolitan areas is only slightly below the national average for all persons.


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## New Site for National Library of Medicine

The proposed new building for the National Library of Medicine will be constructed on the grounds of the Public Health Service's National Institutes of Health in Bethesda, Md. Selection of a site for the library was made by the board of regents of the library at its second meeting on April 29, 1957.

Factors leading to the choice of the specific site were its proximity to two large medical centers, the availability of sufficient land, a good network of transportation, and established supporting services and facilities.

# Climate and Fluid Intake

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GEORGE A. NEVITT, D.D.S., M.P.H., ZACHARY M. STADT, D.M.D., M.P.H., and RUTH E. DART, M.P.H.

NUMEROUS investigators have studied the physiological reaction of adults to specific temperature, humidity, and other variable climatic conditions (*1*, *2*). These studies, initiated primarily by the U. S. Armed Forces, have been concerned largely with man's comfort, efficiency, or survival in the desert, arctic, or other places with severe climatic conditions. There have been a few investigations of the physiological response of children to heat stress under laboratory (*3*) and normal living conditions (*4*, *5*), but data are too limited to describe adequately the influence of climatic factors on the amount and kind of fluid consumed by this group.

Interest in the physiological response of children to climate increased markedly with the advent of community water fluoridation. Epidemiological studies in natural fluoride areas have shown that 1 p.p.m. fluoride represents the optimum level for dental caries control in most of the United States (*6*). However, it has been suggested that in the practical application of the findings less than 1 p.p.m. may be sufficient to give optimum protection in very warm areas because of increased water consumption (*7*).

Galagan and Lamson (*8*) using two biological indexes (fluorosis and dental caries) found that Arizona children, living in a climate where the mean annual temperature is approximately 70° F., had a higher fluorosis index and a lower caries rate than children who used water with the same fluoride concentration but who lived in the midwest where the mean annual temperature is 50° F. They concluded that the Arizona residents drink more water than children living in the more temperate climate.

Since this finding and an earlier pilot study (*5*) indicated that climatic factors do influence water consumption in children, it was decided to investigate the relationship between climate and fluid intake more extensively by measuring, under normal living conditions, the actual amounts of fluid consumed by a large number of children exposed to varying climatic conditions. The study was undertaken jointly by the Public Health Service and the Contra Costa County (Calif.) Health Department, with active support from superintendents, principals, teachers, and nurses of local schools and members and officers of local parent-teacher associations.

## The Field Study

Antioch and Brentwood in Contra Costa County, Calif., were selected as study sites. Both communities experience temperatures

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*Dr. Henrik L. Blum, health officer of Contra Costa County, assisted in carrying out the study reported in this paper. Dewey DiMartini, Mrs. Elsie M. Green, and Mrs. Evelyn G. Ackerman served as volunteer weather observers in Brentwood, and Edward C. Jennings, in Antioch.*

above 90° F. each summer, and both have mild winters, but there is enough difference between the winter and summer months to permit evaluation of seasonal change.

In a series of thirty-nine 5-day study periods during approximately 1 year, records of fluid intake were obtained for 316 Antioch and 139 Brentwood children. In Antioch, there were 27 periods, Monday through Friday, every other week, from November 30, 1953, through December 3, 1954. In Brentwood, data were obtained for one 5-day week each month from January 25, 1954, through December 10, 1954.

The participating children were divided into study groups of 12, a boy and girl in each of 6 age groups ranging from infancy through 10 years. The fluid consumed by each child was recorded for a 5-day period. No child participated for more than one period. With a few exceptions, the participants were distributed equally by sex throughout all six age groups in each study period. In a few instances records were maintained for a given child for fewer than 5 days, and occasionally fewer than 12 children participated in a group. All calculations take these irregularities into account. The age and sex distribution of participants is shown in table 1.

**Table 1. Number of participants, by age and sex, Antioch and Brentwood, Calif.**

| Age in years | Antioch | | | Brentwood | | |
|---|---|---|---|---|---|---|
| | Total | Boys | Girls | Total | Boys | Girls |
| All ages | 316 | 156 | 160 | 139 | 68 | 71 |
| Under 1 | 54 | 27 | 27 | 19 | 8 | 11 |
| 1–2 | 52 | 25 | 27 | 24 | 12 | 12 |
| 3–4 | 54 | 27 | 27 | 24 | 12 | 12 |
| 5–6 | 54 | 27 | 27 | 24 | 12 | 12 |
| 7–8 | 51 | 26 | 25 | 24 | 12 | 12 |
| 9–10 | 51 | 24 | 27 | 24 | 12 | 12 |

The children studied were selected from a roster of potential participants for each town. The rosters were divided into sections according to sex and age groups, and the names of the children in each section were arranged alphabetically. In accordance with a prescribed sampling procedure, the names of possible participants were drawn from the roster. If the parents of a selected child did not agree to participate during the full 5-day period, an alternate child was chosen. Children who were known to be ill were excluded, especially if they had fever. Since participation in the study was voluntary, the children included do not necessarily comprise a sample representative of all children in the two communities.

Each participant was visited at home at least three times. The first visit was made to obtain a firm commitment from the parents that their child would participate and to instruct the parents and the child how to measure and record fluid intake. A plastic cup, calibrated in fluid ounces, and a record book were given to the parents. For each school child, a collapsible cup, also calibrated in fluid ounces, and an additional booklet were issued to the child's teacher, who was given the same instructions as the parents. Teachers of kindergarten and first-grade children maintained the records during school hours, but children in the second grade and above usually maintained their own fluid consumption records, with some teacher supervision.

The second visit took place at the midpoint of the recording period. The child was weighed, any problems in maintaining the fluid-consumption record were discussed, and the record was checked for obvious errors or omissions. The third visit was made at the end of the recording period. The fluid-consumption records were collected from the homes and the schools and were given a final review at this time.

The amount of fluid consumed was recorded in eight categories. The first five categories included either water in its natural form or substances to which water is added in the home: drinking water, formula preparations for babies or reconstituted milk made with water, juices diluted with water, soups diluted with water, and other water-based beverages such as tea or coffee. The other three categories included beverages which do not have water added in the home: carbonated beverages, juices not diluted with water, and other beverages such as whole milk. Water used in cooking, such as that added to vegetables, was not recorded.

The United States Weather Bureau installed

**Table 2. Body weight and amount of all fluids and of water consumed per child, by sex and age, Antioch and Brentwood, Calif.**

| Sex and age in years | Antioch | | | | | | Brentwood | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Body weight (pounds) | | All fluids (ounces per day per pound body weight) | | Water (ounces per day per pound body weight) | | Body weight (pounds) | | All fluids (ounces per day per pound body weight) | | Water (ounces per day per pound body weight) | |
| | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation | Mean | Standard deviation |
| *Boys* | | | | | | | | | | | | |
| Under 1 | 18. 0 | 3. 4 | 1. 77 | 0. 53 | 0. 39 | 0. 46 | 15. 9 | 4. 4 | 2. 01 | 0. 58 | 0. 81 | 0. 60 |
| 1–2 | 30. 6 | 3. 9 | 1. 00 | . 35 | . 44 | . 26 | 29. 4 | 3. 1 | . 96 | . 23 | . 33 | . 15 |
| 3–4 | 37. 6 | 4. 1 | . 94 | . 31 | . 39 | . 19 | 39. 4 | 5. 6 | . 76 | . 16 | . 38 | . 15 |
| 5–6 | 53. 9 | 9. 0 | . 90 | . 29 | . 38 | . 19 | 49. 6 | 8. 2 | 1. 12 | . 50 | . 53 | . 29 |
| 7–8 | 65. 5 | 13. 7 | . 80 | . 24 | . 40 | . 20 | 66. 8 | 8. 9 | . 72 | . 25 | . 39 | . 18 |
| 9–10 | 78. 9 | 13. 3 | . 64 | . 17 | . 34 | . 13 | 77. 5 | 8. 2 | . 73 | . 25 | . 42 | . 29 |
| *Girls* | | | | | | | | | | | | |
| Under 1 | 17. 6 | 3. 3 | 1. 67 | . 53 | . 53 | . 56 | 16. 3 | 1. 9 | 2. 00 | . 56 | . 80 | . 70 |
| 1–2 | 28. 0 | 4. 0 | 1. 17 | . 53 | . 43 | . 33 | 27. 6 | 5. 0 | 1. 11 | . 66 | . 44 | . 35 |
| 3–4 | 38. 0 | 5. 8 | . 97 | . 33 | . 41 | . 23 | 37. 0 | 5. 1 | . 70 | . 21 | . 33 | . 20 |
| 5–6 | 49. 5 | 11. 9 | . 87 | . 36 | . 39 | . 19 | 50. 5 | 5. 2 | . 85 | . 26 | . 31 | . 15 |
| 7–8 | 65. 1 | 12. 9 | . 74 | . 22 | . 36 | . 20 | 61. 2 | 15. 5 | . 76 | . 23 | . 40 | . 21 |
| 9–10 | 81. 2 | 18. 6 | . 64 | . 26 | . 33 | . 17 | 72. 7 | 11. 6 | . 73 | . 43 | . 38 | . 23 |

and maintained the equipment needed for recording climatologic observations in each community. The equipment consisted of maximum and minimum thermometers, wet and dry bulb thermometers, a fan, and a hygrothermograph for recording temperature and humidity continually during a 24-hour period. Since the Weather Bureau staffs its weather stations with volunteers, volunteers were recruited in each community to serve as weather observers. They read the wet and dry bulb thermometers and recorded the dew point three times each day, 9 a. m., noon, and 5 p. m. They read the maximum and minimum thermometers once each day and recorded rainfall whenever it occurred. The data from the hygrothermograph were checked against the manual observations, and any necessary changes were made in the data according to procedures outlined by the Weather Bureau climatologist.

### Climatologic Findings

Two of the most common expressions of climate are temperature and humidity. However, no one of the many measures of temperature or humidity is recognized as the best measure of these factors. Among the possible ways temperature or humidity can be expressed are the 24-hour mean, the 7 a. m. to 6 p. m. mean, the daily maximum, the mean of the maximum and the readings on the hours preceding and following the hour in which the maximum occurs, the 3 p. m. reading, and the daily mean calculated by averaging the maximum and minimum.

From a practical standpoint, all six measures could not be used in the analysis. To identify the ones that reflect most accurately the climatic conditions to which the children in the study were exposed, rank order correlations of these measures were done.

For temperature, an average of each of the aforementioned expressions was calculated for each observation period during which fluid-intake records were maintained, and each of the measures was then ranked according to the period in which the particular expression ranked highest, next highest, and so on. Coefficients of concordance were 0.986 for Antioch and 0.975 for Brentwood. Since the correlation between the rankings of the various temperature expressions is so high, it may be concluded

that any one of the measures is as good as any other to describe the temperature factor in this climatic environment. The daily maximum temperature is used here since it reflects the extremes of heat to which an individual is exposed and since it is a measure generally available wherever weather observations are recorded.

For the rank order correlation of humidity expressions, minimum humidity was used instead of maximum humidity since the latter approached 100 percent at some time nearly every day, particularly in the early morning hours. The result of the correlation is similar to that for temperature, and it is concluded that any one of these measures of humidity adequately describes the humidity factor in this climatic environment.

It has been assumed by many investigators that humidity has an important effect on fluid intake, although the extensive observations reported by Adolph indicate otherwise (*1*). It was hoped that this study would provide additional information on the subject. However, combinations of high temperature and high humidity, which would be required to detect any

**Table 3. Percentage distribution of ounces of each kind of fluid consumed,[1] Antioch and Brentwood, Calif.**

| Kind of fluid consumed | Antioch | Brentwood |
|---|---|---|
| All fluids | [2] 100.0 | [3] 100.0 |
| Drinking water | 33.8 | 36.4 |
| Water based beverages | 9.6 | 11.2 |
| Milk | 47.9 | 39.9 |
| Carbonated beverages | 3.0 | 3.6 |
| Other fluids | 5.7 | 8.9 |

[1] During 1,539 child-days in Antioch and 681 in Brentwood.
[2] 61,810 ounces.
[3] 27,044 ounces.

**Table 4. Percentage distribution of participants by ounces of all fluids, water, and all other fluids consumed per day per pound of body weight, November–March and April–October, Antioch and Brentwood, Calif.**

| Ounces fluid consumed per day per pound of body weight | Antioch | | | | | | Brentwood | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | November–March [1] | | | April–October [2] | | | November–March [3] | | | April–October [4] | | |
| | All fluids | Water | All other fluids | All fluids | Water | All other fluids | All fluids | Water | All other fluids | All fluids | Water | All other fluids |
| Total | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Less than 0.2 | 0 | 34.3 | 6.4 | 0 | 15.3 | 8.0 | 0 | 39.7 | 8.6 | 0 | 13.6 | 9.9 |
| 0.2–0.3 | 5.0 | 42.9 | 30.8 | 0 | 34.8 | 24.4 | 3.4 | 32.8 | 36.3 | 2.5 | 33.2 | 32.2 |
| 0.4–0.5 | 20.0 | 12.1 | 25.7 | 11.9 | 27.8 | 29.0 | 25.9 | 13.8 | 31.1 | 12.3 | 23.5 | 22.2 |
| 0.6–0.7 | 27.0 | 4.3 | 17.1 | 21.0 | 11.9 | 17.0 | 32.9 | 5.2 | 6.9 | 19.8 | 14.8 | 13.6 |
| 0.8–0.9 | 15.0 | 4.3 | 6.4 | 22.1 | 3.4 | 8.0 | 19.0 | 1.7 | 1.7 | 23.5 | 6.2 | 8.6 |
| 1.0–1.1 | 8.6 | 0 | 4.3 | 15.3 | 3.4 | 4.5 | 1.7 | 0 | 5.2 | 14.8 | 2.5 | 11.1 |
| 1.2–1.3 | 7.9 | 1.4 | .7 | 13.1 | 1.1 | 3.4 | 1.7 | 1.7 | 1.7 | 6.2 | 2.5 | 1.2 |
| 1.4–1.5 | 5.0 | 0 | .7 | 4.0 | .6 | 1.7 | 1.7 | 1.7 | 3.4 | 6.2 | 2.5 | 0 |
| 1.6–1.7 | 2.9 | .7 | 2.9 | 3.4 | 1.7 | 1.7 | 0 | 3.4 | 3.4 | 2.5 | 0 | 0 |
| 1.8–1.9 | 2.9 | 0 | .7 | .6 | 0 | 0 | 6.9 | 0 | 1.7 | 4.9 | 0 | 1.2 |
| 2.0–2.1 | 3.6 | 0 | 2.9 | 3.4 | 0 | .6 | 0 | 0 | 0 | 2.5 | 1.2 | 0 |
| 2.2–2.3 | 1.4 | 0 | .7 | .6 | 0 | 1.1 | 1.7 | 0 | 0 | 2.5 | 0 | 0 |
| 2.4–2.5 | 0 | 0 | 0 | 2.8 | 0 | 0 | 1.7 | 0 | 0 | 1.2 | 0 | 0 |
| 2.6–2.7 | 0 | 0 | .7 | .6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.8–2.9 | .7 | 0 | 0 | .6 | 0 | .6 | 1.7 | 0 | 0 | 0 | 0 | 0 |
| 3.0–3.1 | 0 | 0 | 0 | 0 | 0 | 0 | 1.7 | 0 | 0 | 1.2 | 0 | 0 |
| 3.2 or more | 0 | 0 | 0 | [5].6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

[1] Number of participants; 140; mean maximum temperature: 59.7° F.; temperature range: 56.6°–62.2° F.
[2] Number of participants: 176; mean maximum temperature: 82.3° F.; temperature range: 74.1°–95.5° F.
[3] Number of participants: 58; mean maximum temperature: 58.6° F.; temperature range: 56.8°–62.2° F.
[4] Number of participants: 81; mean maximum temperature: 85.6° F.; temperature range: 79.2°–97.6° F.
[5] 3.4 ounces.

possible additional effect of humidity on fluid intake, did not occur in the study communities. For example, in Antioch there were 66 hourly observations of temperatures of 90° F. or higher during the recording periods. For the same hours, humidity did not exceed 39 percent and often went below 20 percent. Analysis of the relationship between humidity and fluid intake will not be presented since a correlation between the mean maximum temperature and the mean minimum humidity in each community demonstrated an inverse relationship approaching unity. This inverse relationship between temperature and humidity is not limited to the western United States; in fact, it appears to be a common phenomenon (*9*, *10*).

Studies of man in the tropics indicate that relative humidity up to 80 percent does not add to thermal stress (*1*). It is unlikely, therefore, that humidity has an important influence on fluid intake among children. However, further study of the possible independent effect of humidity on fluid intake in areas where high temperature and high humidity occur simultaneously may be indicated. One such area is adjacent to the Gulf of Mexico.

### Temperature and Fluid Intake

In this report the term "temperature" refers to mean maximum temperature for the periods that data on fluid intake were recorded. The term "fluid" refers to all fluids consumed. Other types of fluids are mentioned specifically by name when comments refer to them. Data for both Antioch and Brentwood are presented in each table, but unless otherwise specified only the Antioch data are discussed. Since fewer than half as many observations were made in Brentwood as in Antioch, the Brentwood data do not have the same degree of reliability as those for Antioch. Generally speaking, the findings for Antioch hold true for Brentwood.

Both total fluid intake and water intake per pound of body weight decreased with increase in age, as shown in table 2. This decrease resulted mainly from the increase in body weight with age, not from an actual decrease in the total amount of fluid consumed. Correlations of both total fluid intake and water intake with body weight are significant at the 1 percent level, although the correlations are not unity. Thus, a 10-year-old child drinks more fluid than an infant, but not in direct proportion to the weight difference between the two individuals. No important differences between boys and girls in the amount of fluid consumed are apparent.

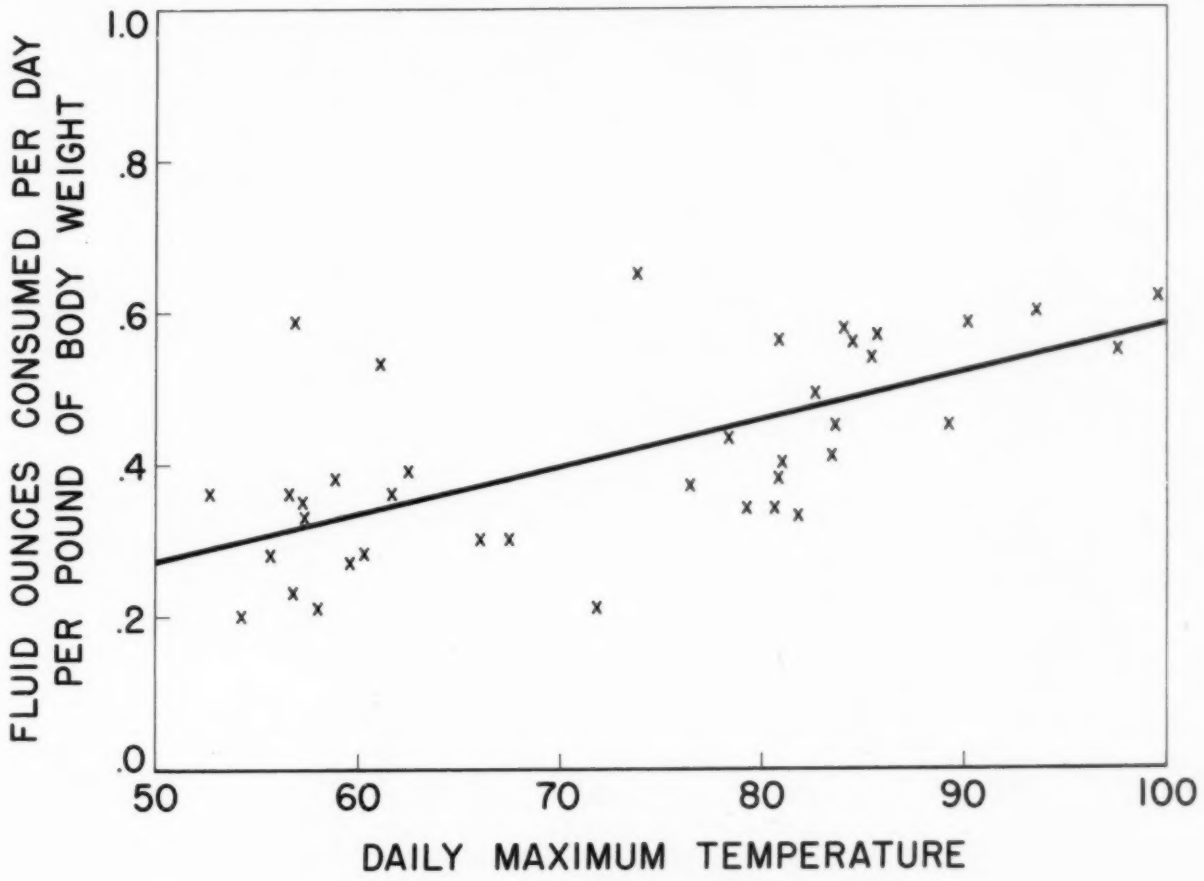
Water accounted for about 43 percent of the total fluid consumed (table 3). Slightly less than one-half of the fluid consumed was milk. This amount represents fluid milk and does not include formula preparation made with a water base or with powdered milk reconstituted with water. Carbonated beverages and other fluids combined made up less than 9 percent of the fluid intake of the children.

**Table 5. Mean maximum temperature and water intake for each recording period, Antioch and Brentwood, Calif.**

| Mean maximum temperature for recording period | Ounces of water consumed per child per day per pound of body weight | Mean maximum temperature for recording period | Ounces of water consumed per child per day per pound of body weight |
|---|---|---|---|
| *Antioch* | | 83.4 | 0. 41 |
| | | 83.6 | . 45 |
| 52.6 | 0. 36 | 84.4 | . 56 |
| 54.2 | . 20 | 85.4 | . 54 |
| 55.6 | . 28 | 90.2 | . 58 |
| 56.6 | . 36 | 93.6 | . 60 |
| 57.4 | . 32 | 99.6 | . 62 |
| 58.0 | . 21 | | |
| 58.8 | . 38 | *Brentwood* | |
| 60.2 | . 28 | | |
| 61.0 | . 53 | 56.8 | . 23 |
| 61.6 | . 36 | 56.8 | . 59 |
| 66.0 | . 30 | 57.2 | . 35 |
| 67.4 | . 30 | 59.6 | . 27 |
| 71.8 | . 21 | 62.4 | . 39 |
| 73.8 | . 65 | 79.2 | . 34 |
| 76.4 | . 37 | 80.8 | . 56 |
| 78.2 | . 44 | 82.6 | . 49 |
| 80.6 | . 34 | 84.0 | . 58 |
| 80.8 | . 38 | 85.6 | . 57 |
| 81.0 | . 40 | 89.2 | . 45 |
| 81.8 | . 33 | 97.6 | . 55 |

Correlations of temperature with total fluid, with drinking water, with water-based beverages (as defined), with total water, and with carbonated beverages were significant at the 1 percent level. Correlations were equally significant when body weight was equated to account for the possible effect that weight differences might have on fluid consumption. A

**Relationship between daily maximum temperature and water intake among children, Antioch and Brentwood, Calif.**




negative relationship, significant at the 5 percent level, was demonstrated between other fluids (milk and all other fluids which do not contain water added in the home except carbonated beverages) and temperature, both with and without body weight equated.

The only major differences found for Brentwood were these: Temperature did not correlate significantly with carbonated beverages or with other fluids (as defined in the preceding paragraph); correlations of temperature with total fluid and with drinking water were significant at the 5 percent level without body weight equated and at the 1 percent level with body weight equated.

The significant negative correlation demonstrated in Antioch between temperature and intake of fluids other than water, water-based beverages, and carbonated beverages may result from a decrease in intake of milk as temperature increases and water and cooling drinks are substituted for milk. This pattern of behavior has been observed previously in infants (*3*).

Of primary interest are the water consumption data in table 4 for two periods, November through March, when the temperature averaged 60° F., and April through October, when the temperature averaged 82° F. A decided shift to greater water intake during the higher temperature period is reflected in these data. However, under conditions of both high and low temperature, more than 90 percent of the children drank less than 1 ounce of water per day per pound of body weight. No such shift was discernible in the consumption of fluids other than water.

The relationship between temperature and water consumption is shown more precisely in table 5 and in the chart. The plotted points on this chart represent the mean amounts of water

consumed per child per day per pound of body weight for each recording period in each community. The line is derived from the estimation equation "ounces of water per pound of body weight = $-0.038+0.0062$ temperature," based on the data in table 5.

The findings for the two communities so closely approximate each other that data for both Antioch and Brentwood were used as the basis for deriving the equation that describes the relationship between temperature and water consumption. A straight line was calculated but the line should not be extended beyond the maximum temperature range of 50° to 100° F.

The line representing water consumption rises as temperature increases. This relationship has been described earlier by the positive correlation between water consumption and temperature. It may be concluded from these observations that the direct method of measuring water intake in children exposed to varying temperatures, under normal living conditions, confirms earlier observations obtained by using indirect biological measurements that the amount of water consumed by children increases with increases in temperature.

## Summary


1. Records of fluid intake for 455 Antioch and Brentwood, Calif., children from infancy through 10 years of age were obtained during thirty-nine 5-day observation periods in a period of 1 year. Detailed temperature and humidity data also were obtained throughout the year.

2. Rank order correlations showed that any one of several expressions could be used to describe the climatic variables, temperature and humidity. Maximum temperature and minimum humidity were selected as the expressions of choice.

3. Humidity was associated negatively with temperature to such a high degree that it was not possible to determine whether humidity might have some additional effect on fluid consumption in areas where high temperature and high humidity occur simultaneously.

4. Fluid intake per pound of body weight was highest among infants and decreased with age.

5. There were no substantial differences between boys and girls in the amount of fluid consumed per pound of body weight.

6. Under normal living conditions, water intake increased directly with increases in temperature.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# *Determining Optimum Fluoride Concentrations*

DONALD J. GALAGAN, D.D.S., M.P.H., and JACK R. VERMILLION, M.P.H.

On the basis of the fluid intake study in Antioch and Brentwood, Calif., reported on pp. 484–490, Dr. Galagan and Mr. Vermillion, of the Public Health Service, have developed the method described here for determining optimum fluoride concentrations in water supplies. This method takes into account the effect of environmental temperature on water consumption among children.

THE FLUID intake study among children in Antioch and Brentwood, Calif., in 1953–54 provides a basis for determining the optimum fluoride concentration in water supplies in relation to environmental temperature. This study showed that for every degree increase in maximum daily temperature between 50° and 100° F. water intake increased, on the average, by 0.062 ounces per pound of body weight. For example, the average daily water consumption per pound of body weight was 0.272 ounces when the maximum daily temperature was 50° F. and 0.334 ounces when the maximum daily temperature was 60° F.

The relationship between maximum temperature and water intake for the California children was described by the estimation equation "ounces of water per pound of body weight= $-0.038+0.0062$ temperature." The validity of this equation should perhaps be checked by studies in other areas of the country, but in the meantime it can be used to illustrate the calculation of optimum fluoride concentrations. As will be pointed out later in the paper, results obtained with the equation in the Chicago area, where optimum fluoride concentration is known from epidemiological studies, indicate that it is reasonably reliable.

The basic structure of the formula developed for estimating optimum fluoride concentrations is: parts per million of fluoride=optimum water consumption÷estimated water consumption. Thus, the optimum fluoride concentration for a given community is equal to a constant (the average amount of water containing 1 p.p.m. fluoride that affords optimum protection against dental caries) divided by the estimated water consumption of children in a given community. Both measures are in ounces of water consumed daily per pound of body weight.

If daily maximum temperature data for the Chicago area are applied to the water estimation equation, it is possible to calculate a denominator value for the formula, that is, the average amount of water that would be consumed daily per pound of body weight by children in the Chicago area aged 10 years or less. The number derived, although it has no particular meaning in itself, may also serve as the constant for the formula, since it is known from epidemiological data that the optimum fluoride concentration for the Chicago area is 1 p.p.m. The constant, or numerator, in the formula must equal the estimated water consumption, or denominator, for the optimum fluoride concentration to be 1 p.p.m.

The estimated water consumption for the Chicago area children is based on weather data for two towns, Maywood and Joliet. Since both of these towns were included in the early studies of Dean (*1*), the fluoride concentration

**Table 1. Mean maximum temperatures and calculated optimum fluoride concentrations for selected communities in the United States**

| Community | Mean maximum temperature [1] | Calculated optimum fluoride concentration |
|---|---|---|
| Arizona: | | |
| Chandler Heights | 85.3 | 0.7 |
| Tucson | 82.6 | .7 |
| California: | | |
| Los Angeles | 73.9 | .8 |
| San Francisco | 61.7 | 1.0 |
| District of Columbia | 68.7 | .9 |
| Illinois: | | |
| Joliet | 61.6 | 1.0 |
| Maywood | 61.8 | 1.0 |
| Louisiana: | | |
| New Orleans | 78.7 | .8 |
| Shreveport | 77.7 | .8 |
| Montana: | | |
| Billings | 59.1 | 1.0 |
| Butte | 51.7 | 1.2 |
| North Carolina: | | |
| Charlotte | 72.7 | .8 |
| Rocky Mount | 73.2 | .8 |

[1] Based on temperature data for the 5-year period 1951–55 from U. S. Weather Bureau publications entitled "Climatological Data."

and the fluorosis index are known. Although both communities have more than 1 p.p.m. of fluoride in their water supplies, 1 p.p.m. is considered the optimum concentration.

The estimated average water consumption, the denominator of the formula, which is hereafter called $E$, is calculated by obtaining the mean maximum temperature for at least a 5-year period for the community in question and substituting this figure in the estimation equation $E = -0.038 + 0.0062$ temperature. The resulting value represents the average number of ounces of water per pound of body weight that children through 10 years of age would be expected to drink daily under the temperature conditions of the community. The $E$ value for both Maywood and Joliet is 0.34, and, as explained previously, this number may serve as the constant for the formula.

The value 0.34 for the constant is reasonable from the standpoint of optimum fluoride ingestion through water. For example, again in terms of average phenomena, 0.34 ounces of water fluoridated at 1 p.p.m. contains approximately 0.011 mg. of fluoride. In the fluid intake study in California, the average body weight of children studied was about 46.5 pounds. At this weight, the children ingest about 0.5 mg. of fluoride daily through their drinking water. This amount is similar to other estimates of the amount of fluoride that should be ingested through water for optimum dental health (*2*). This fact tends to strengthen confidence in both the constant and the water estimation equation from which it was derived.

With the formula "parts per million of fluoride $= 0.34 \div E$," optimum fluoride concentrations have been calculated for selected communities representing various geographic areas throughout the United States. The results are shown in table 1. For the cities listed, the lowest concentration, 0.7, is suggested for the Arizona communities; the highest, 1.2, for Butte, Mont.

To obtain a fluoride concentration lower than 0.7 p.p.m. with this formula, the mean maximum temperature would have to average at least 90.6° F. To obtain one greater than 1.2 p.p.m., the mean maximum temperature would have to be lower than 50° F. The possibility of the occurrence of either of these extremes in the United States seems remote. Consequently, it is not expected that the optimum concentration for any community would be outside the range 0.7–1.2 p.p.m. generally recommended for fluoridation.

In the practical application of the method described here for determining optimum fluoride concentrations, it is not necessary to make calculations for each community. Opti-

**Table 2. Mean maximum temperatures and corresponding recommended optimum fluoride concentrations**

| Mean maximum temperature (degrees Fahrenheit) | Recommended optimum fluoride concentration (parts per million) |
|---|---|
| 50.0–53.7 | 1.2 |
| 53.8–58.3 | 1.1 |
| 58.4–63.8 | 1.0 |
| 63.9–70.6 | .9 |
| 70.7–79.2 | .8 |
| 79.3–90.5 | .7 |

mum fluoride levels for ranges of mean maximum temperatures from 50° through 90.5° F. are presented in table 2. The optimum fluoride concentration for a community may be determined simply by obtaining the mean maximum temperature for a 5-year or longer period from appropriate publications of the United States Weather Bureau and then referring to this table.

Two points must be stressed in the application of this method. First, the temperature figure should be at least a 5-year average for the figure to be truly representative. Second, the mean maximum temperature in degrees Fahrenheit is the only measure that can be used since the method is based on an equation for estimating water consumption in which this measure is used.


## Summary

The following formula, which takes into account variations in environmental temperature, is suggested for determining optimum fluoride concentrations for community water supplies:

$$\text{parts per million of fluoride} = \frac{0.34}{E}$$

The figure 0.34 (optimum water consumption) was calculated from data for an area where the optimum fluoride concentration is known. $E$ is the estimated average daily water intake for children through 10 years of age in ounces per pound of body weight. It may be calculated from the estimation equation $E = -0.038 + 0.0062$ temperature, where temperature is the mean maximum temperature in degrees Fahrenheit.

A table showing suggested optimum fluoride concentrations for communities with 5-year mean maximum temperatures of 50° through 90.5° F. is presented.


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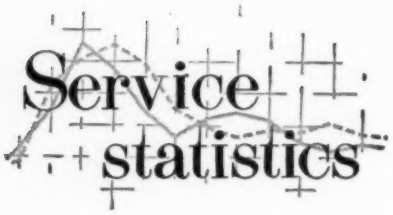
## Training in Care of Prematures

The institutes for physicians and nurses in the care of premature infants at the New York Hospital-Cornell Medical Center will begin their ninth year in the fall of 1957. The institutes are sponsored by the New York State Department of Health and the Children's Bureau.

The training is designed for physicians and nurses in charge of hospital premature nurseries and premature centers, and medical and nursing directors and consultants in State and local premature programs.

Attendance at each institute is limited to six physician-nurse teams. The program for physicians lasts 2 weeks and that for nurses, 4 weeks. Participants pay no tuition fee, and stipends are provided to help cover expenses during attendance. Institutes are scheduled to start on September 30, 1957, November 18, 1957, and January 6, 1958. If the number of applicants is sufficient, fourth and fifth institutes will be scheduled, beginning March 3, 1958, and late in April or May 1958.

For additional information write to Box 143, Institute in the Care of Premature Infants, New York Hospital, 525 East 68th Street, New York 21, N. Y.




# For Home Accident Prevention Programs

ACCIDENTS in the home have become increasingly important as a cause of personal injury and loss of life; therefore, State and local health departments are recognizing the need for greater attention to home accident prevention. Since preventive programs are not yet being carried out to any great extent, techniques for evaluation of services are in an early stage of development. Because of the limitations in measuring certain phases of accident prevention, attention is directed here only to those items which are measurable.

While determination of program objectives does not fall within the scope of this guide, it is recognized that a long-range objective of home accident prevention is to lower the occurrence of accidental injuries, thus reducing morbidity and mortality.

It is essential to delineate that portion of the total objectives toward which the program is being directed at any one time. For example, one phase of the program may be directed toward reduction of accidents from certain causes, another toward prevention of accidents among certain population groups such as children or the aged, another toward reduction of accidents of designated severity, and still another toward increasing the awareness of accident-producing situations. Whatever the immediate focus of the program the objective should be clearly stated.

Determination of the steps toward achieving the long-term objective of a home safety program usually leads to the organization of the program under the following general types of activity:

- Orientation and inservice training of the public health staff.
- General education of the public.
- Specific services to individuals and groups.

The job of home accident prevention belongs to all workers in the field of public health. At an early stage, program planners must enlist the help of the health educator, the statistician, and other staff service personnel. The staff should function as a part of the professional team throughout the stages of program planning, operation, and evaluation (*1*).

In evaluating any public health service it is necessary that there be a clear understanding on the part of all concerned regarding definition of terms used. Lack of such understanding leads to considerable loss of comparability of data and thus minimizes the value of evaluative studies. An effort is being made to standardize definitions and study is continuing through the Conference on Definitions of Accidents (*2–4*).

## *Statistical Information*

### Measuring Extent and Nature of Problem

For study and comparison, accident experience is best expressed in terms of both numbers and rates of death and, wherever possible, nonfatal injuries. Detailed facts about home accidents should be compiled and made available to all agencies concerned with public health.

## Service Statistics Series

A series of documents on the collection, analysis, and interpretation of service statistics for various health department programs is being developed by the Working Group on Service Programs, Public Health Conference on Records and Statistics.

An introduction to the series and the basic principles governing service statistics in public health appeared in June 1956, Public Health Reports, page 519. These were followed in the July issue, page 705, by a statement on service statistics for the health supervision of infants and preschool children. Statistics on health services for children of school age was the subject of the third report, published in September 1956, page 917.

In developing this fourth report, which is a guide to statistical services in the planning, administration, and evaluation of public health services in home accident prevention, the working group had the assistance of several consultants with especial experience in programs for the prevention of home accidents.

This report was approved by the conference membership in the autumn of 1956. It was reproduced in mimeographed form as attachment A to document 370 by the National Office of Vital Statistics, Public Health Service, Department of Health, Education, and Welfare, Washington, D. C. It has the endorsement of the Statistics Section and the Committee on Administrative Practice of the American Public Health Association, the National Safety Council, and the Council of State Directors of Public Health Nursing.

In addition to assessing the extent and severity of the problem, there is need for taking stock of present activities in the field. The Proceedings of the First and Second Michigan Conferences on Home Accident Prevention (*2*) discuss facts, figures, and findings. The individuals, families, or groups served by public health and allied workers should also be studied. Analysis of the causes of accidental injuries and deaths is a means of identifying and substantiating specific problem areas (*3–6*).

The following items are suggested guides to the measurement of the problem for the purposes of emphasizing the areas in which activities might be most effective. Such measurement directs the planning of sound programs, provides the basis for needed legislation, and encourages the development of new standards through voluntary action. To be most meaningful, the suggested facts must be considered not only in themselves but also in relation to each other. These are by no means all of the facts and circumstances which may be classified for study nor does the order of their listing suggest their relative importance.

### Data on area

Distribution of population by age, sex, and race.
Other descriptive information.

### Data on fatal and nonfatal accidents

A complete description of the accident, the nature of the injury, and the consequences of the accident and injury will serve as a guide to measurement of the problem.

Age, sex, and race of the victim.
Activity at time of accident.
Probable cause of accident (personal or environmental factors).
Location on premises where accident occurred.
Time of day, week, or season.
Physical agent involved in accident.
Physical agent producing injury.
Manner and nature of injury.
Duration of disability.
Medical attention or hospitalization.
Wages lost, property damage, and other costs.
Medical and nursing costs.
Cause of death.
Place of death.

### Data on other related factors

Sources of information such as victim, family, or neighbor.
Occupation of victim or head of household.
Physical condition of victim.
Type of home.
Location of home: urban, farm, or nonfarm.
Physical factors of general home environment.
Size of family.
Number of previous accidents.
Economic factors, if possible.
Other persons involved in accident.

### Data on community knowledge and attitudes

Attitudes toward home accident prevention.
Knowledge of and attitude toward accident producing situations.
Possible ways of avoiding occurrence of similar accidents.
Suggested ways of avoiding recurrence of the accident.
Sources of health and safety information.

Because of the difficulty of measuring knowledge and attitudes little information is available. However, the bureau of maternal and child health of the New Jersey Department of Health has conducted a study designed to obtain data relating to these subjects (*7*).

## Sources of Data

There are many limitations to be considered in determining sources of data for planning and administering a program. Questions which must be answered are (*2*): How reliable are the sources? Are they valid? Do they assure completeness of information?

Following are some suggested sources of data on fatal and nonfatal accidents.

### Fatal accidents

- Death certificates supplemented by data collected with the National Office of Vital Statistics Home Accident Fatality Report or a similar epidemiological report.
- Hospital or emergency room reports if arrangements are made for the inclusion of detailed information about the accident.
- Reports of the medical examiner following inquiry into the circumstances of the accident.

### Nonfatal accidents

- Sample surveys of homes.
- Surveys through schools, industries, service and social organizations.
- Hospital, clinic, and physician's reports, and poison information centers.
- Epidemiological reports collected by public health nurses, sanitarians, or others as a special project (*8*).

## *Measuring Effectiveness*

Home accident prevention programs are not uniform; they vary with the nature of the problem and the staff available. Therefore, the following suggestions need to be adapted accordingly.

Many of the items suggested for use in evaluation need not be collected and analyzed continuously. Periodic studies, especially of newly developed programs, are a valuable aid to program evaluation and revision.

Evaluation of home accident prevention programs has two major aspects:

- Evaluation of the entire program in relation to the long-range objectives.
- Evaluation of specific activities and services of the program in relation to the immediate objectives.

To be of maximum value, evaluation should be performed periodically. It should be followed by reexamination of the program in terms of both immediate and long-range objectives. Unsatisfactory progress indicates a need to replan the program and possibly to redefine objectives (*9*).

## Long-Term Effect of Community Program

Collection and analysis of the following data may help gauge the effectiveness of an accident prevention program in achieving its ultimate goal:

- Trend of death rates from home accidents with respect to such factors as manner of injury, object involved, age, race, and sex.
- Indexes of change in nonfatal injuries by data from hospitals, emergency rooms, or, in some cases, from area surveys.

Caution must be used in drawing conclusions from the data. Evidence of change within a given area should not in itself be considered an adequate measure of the program's effectiveness. Comparisons with changes in a comparable area that does not have a preventive program help to strengthen the evidence regarding the effect of the program.

## Effect of Health Department Services

A record of the number of activities, the time spent on them, and whatever measurable work is done does not necessarily indicate the health department's contribution to a communitywide program. It is necessary to supplement the records of the number of activities by some study of the content of the

services and the extent to which they have accomplished their purpose.

### Staff orientation and inservice training

Measurable activities in staff training might include a series of lectures and demonstrations for local health department staffs by persons with special competence in home accident prevention. Material presented would include current statistics indicating the problem and reasons for integrating home accident activities with all public health work. This might be preceded and followed by written tests and field practice to determine the information level of the staff. Orientation of the staff to the use of techniques in reducing home accidents would be a part of this inservice training.

### Public education activities

Public education by health authorities would include classes, lectures, exhibits, radio programs, and printed matter. This is a difficult area for which to establish objective indexes of accomplishment. However, a few suggestions for gauging increased knowledge and change in habit patterns might be measured by before and after quizzes, the use of checklists, and by counting requests for services and materials. Records of the number of requests will be more meaningful if they include a study of the characteristics of the groups being reached, with age, sex, and occupation indicated.

Because allied agencies are active in the educational phase of home accident prevention, it is difficult to pinpoint the effectiveness of health department work per se (*10*). The most valid study of the effect of materials used through mass media (radio, television, posters, pamphlets) might be made by the national agencies that develop the material (*11*, *12*). Results of such evaluation should be available to local health departments for use in determining the educational medium to be used.

Another indication of the value of health department activities is in the number of second requests for speakers, literature, and consultation. This, of course, measures only requests for assistance, not the effect of it.

### Specific services to individuals and groups

Recording of hazards, dangerous practices, and their correction (or continuation) may be included in activity reports, either routinely or by special arrangement. These records will provide evidence of home accident prevention services given to individuals or groups. To stimulate the correction of hazards, a health worker may distribute, for example, calendars for recording home accidents or Christmas tree tags with fire prevention instructions (*13*). He measures the effectiveness of these activities by counting the number of homes in which the calendars or tags are used. The number may not be the same as that of the homes to which the materials were sent.

Services to groups include such activities as lectures, program guidance, and panel participation.

The amount of time devoted by public health personnel in teaching home accident prevention should be measured for a short period. For example, periodic spot checks of the accident prevention content of the records of nurses and sanitarians may prove useful.

Records which need not be kept continuously but would prove valuable over a selected period of time concern referrals of individuals to specialized services and corrections effected. Suggested as examples are referrals of persons to clinics or private physicians because of poor vision or other physical handicaps, including congenital malformations and emotional disturbances.

A record of referrals and cooperative effort between groups active in home accident prevention adds meaningful evaluative information. The next logical step is the recording of the followup activities and their results. Records of referrals of environmental hazards may be those to:

- Gas companies for checking and correcting leakage, inadequate venting, or faulty operation.
- Electric companies for overloading, faulty equipment, or short circuits.
- Other fuel suppliers for inspection and correction of oil or coal furnaces and heaters.
- Municipal fire department for testing extinguishers, advice in correcting fire hazards.

• Municipal building department for advice in correcting structural defects.

• Manufacturers of household equipment, appliances, and furnishings.

Builders and contractors are among other groups offering a field for activity. In connection with new housing site inspections, recommendations for safe building and the number actually carried out provide a clue to the effectiveness of this field of work (*14*).

## *Studies*

The 8 State and 4 local demonstration programs in home accident prevention, sponsored by grants from the W. K. Kellogg Foundation, have had accelerated experience in this field which may provide resources on special studies and service statistics (*15*). Baseline values of morbidity and mortality, activity counts, and service statistics of program activities were obtained by various methods in these demonstration programs. For additional reference and further information, health officers of the following departments or the directors of the home accident prevention programs may be contacted: local health departments—Cambridge (Mass.), Mansfield (Ohio), San Jose (Calif.), Kalamazoo (Mich.); State health departments—California, Georgia, Kansas, Kentucky, Maryland, Massachusetts, North Carolina, Oregon.

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# Limitations on the Recreational Use of Domestic Water Reservoirs

CHARLES E. SMITH, M.D., D.P.H., and HENRY J. ONGERTH, B.S., M.P.H.

IN the public health sense, impounding reservoirs may be considered as falling into two general classes, those developed primarily for domestic water supply and those serving a whole spectrum of multipurpose uses. This paper applies only to reservoirs developed primarily for domestic water supply. In California these reservoirs are relatively few in number and represent only a small percentage of the total surface area of fresh water lakes in the State. However, their accessibility makes them especially convenient for recreational use.

In California, there is a conflict of interest in proposed recreational uses of domestic water supply reservoirs. Pressures of increasing population and increasing need for the limited water resources of the State result in an ever-growing appreciation that there must be maximum, and therefore multiple, use of our water resources. This multiple use may include recreational activities. People have more leisure time with more need for recreation than in the past, and, as cities grow larger, there is less and less room for this recreation. For these reasons people interested in recreation desire to use all possible reservoirs and watersheds. The California State Board of Public Health officially expressed its position with respect to such use in a resolution which it adopted in 1955:

"The State Board of Health recognizes its responsibility for promoting the total health of the people of California and is cognizant of the beneficial role of adequate recreational facilities in the promotion of health. The board recognizes that in certain situations recreational use of water supplies under proper restrictions is feasible."

However, there is universal agreement that any possible damage to public health in the use of domestic water supply reservoirs must be prevented.

The California State Board of Public Health and the California State Department of Public Health neither compel nor prohibit the recreational use of domestic water supply reservoirs. Their stand is that this option is a local responsibility. In turn, the State's responsibility is to evaluate proposals for recreational use and to determine whether they provide sufficient safeguards to protect the public health.

There are two important factors to consider in this public health problem—hazards of disease transmission and esthetic considerations.

## Transmission of Disease

We have considerable knowledge concerning risk of disease transmission, although it is admittedly incomplete. So far as we know, the

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major disease potential in recreational use of water supply reservoirs is from improper disposal of human wastes, especially the feces, of those using the reservoir and watershed area. The inability to control all wastes leaves a potential hazard of some disease transmission.

Experience with water supply reservoirs in California now used for recreation has demonstrated that absolute control of human wastes has never been achieved. If control is lax, feces may be deposited directly in the water or on watershed lands. The hazard from the deposition of feces on land is obvious: falling rains and surface runoff will carry the material into the reservoir, pathogenic organisms may travel to the point of water intake from the reservoir, and, unless they are destroyed or removed by treatment, they may ultimately flow to the consumer.

When conditions exist which permit fecal discharges to enter raw water, it is important to know the fate of the pathogenic organisms. Using *Salmonella typhosa* as an example, the literature related to its survival in feces, soil, and water is of interest. Various conflicting reports have been summarized by Rudolfs and his coworkers from Rutgers University (*1*). From their summary, two things are clear: The bacteria may survive for periods as long as 100 days in feces or on soil, and the bacteria survive longer in pure water than in polluted water. This second observation is of critical importance to the waterworks industry, as pointed out by Taylor (*2*), who wrote: "Pollution of pure or purified waters at waterworks, in service reservoirs, or in mains is thus particularly dangerous, and the most stringent precautions are necessary to protect water prepared for delivery to consumers."

The clean water of many domestic water supply reservoirs and of all distribution reservoirs provides minimal biological competition for pathogenic micro-organisms which may contaminate it. Therefore, the opportunities for survival of pathogens are greater. On the other hand, in large impounding reservoirs and natural lakes, the factors of time, dilution, and sedimentation can enable recreational use of water without compromising the quality of the water as withdrawn for treatment. Water supply intakes must be protected by establishing a closed area around them to prevent direct introduction of contaminating materials. Furthermore, care must be given to the location and design of the intake works to take advantage of the factors of time, dilution, and sedimentation.

Appropriate treatment must be provided for all surface water to guard against any pathogens which may elude the natural barriers. Fortunately, *S. typhosa*, and other pathogenic bacteria, are removable from water and are destructible. Investigations and experience have shown that complete water treatment, which includes filtration and postchlorination, can produce a satisfactory finished water from a contaminated raw water. However, we would stress that public health authorities have agreed that there must be bacterial limits for "raw" water whether receiving only chlorination or complete treatment. These limits are expressed in terms of the numbers of coliform bacteria which must not be exceeded if safe water is to be produced by treatment.

While it is agreed that, if not "loaded" too heavily, complete water treatment is adequate to produce a water free from bacteria which cause typhoid fever or other enteric diseases, the problem with respect to some parasites and viruses is not equally simple. Among the parasites we may mention *Endamoeba histolytica*, which causes amebic dysentery. Although amebic cysts normally are removed by filters they are difficult to destroy by chlorine when this is the only treatment employed.

The viruses present another challenge to water safety. Filtration is much less effective in removing viruses than in removing bacteria or parasites (*3*, *4*). While poliomyelitis virus is usually spread by contact between infected and uninfected individuals, it is often present in the feces of healthy persons and has frequently been recovered from sewage. Fortunately, free residual chlorine rapidly inactivates it. The Coxsackie viruses also have been demonstrated in urban sewage. Most Coxsackie viruses do not cause disease, though one epidemic occurred in California during 1956. Like the typhoid bacillus, Coxsackie viruses have been shown to survive longer in unpolluted than in polluted water. They have survived as long as 47 days in river water. While chlorine will inactivate these viruses, from 7 to 46 times

more chlorine is required for killing Coxsackie viruses than for killing *Escherichia coli.*

The newly recognized enteric cytopathic human orphan (ECHO) viruses also are excreted in feces. The role of these viruses in causation of diseases and their manner of spreading disease are as yet undefined although some appear to cause aseptic meningitis which may be confused with poliomyelitis.

Admittedly, poliomyelitis, Coxsackie, and ECHO viruses have never been proved to have produced waterborne epidemics and thus may only be theoretical hazards in water supplies. However, the virus causing infectious hepatitis is known to have caused waterborne outbreaks. The virus of this debilitating disease may badly damage the liver, frequently producing marked and severe constitutional symptoms with prolonged convalescence. The virus never has been cultivated nor have laboratory animals been found to be susceptible so data on its survival are not available. In the massive waterborne epidemic at New Delhi, India, in spite of the presence of a good treatment plant, 10,000 cases of hepatitis occurred.

We must recognize that the public's expectation of perfect performance of water treatment plants may be unduly optimistic. Man may err and equipment may fail. Even though water treatment facilities are provided, safeguards, care, and judgment must be exercised to insure that the capabilities of the installed facilities are not exceeded. We cannot accept the philosophy that it is unnecessary to concern ourselves with the quality of raw water, that all we need to do is spend enough for water treatment facilities to produce a safe and acceptable water.

In milk sanitation, major reliance for protection of milk supplies is placed on pasteurization, but the whole milkshed must provide barriers to contamination. Cows must be guarded against disease and the milk against dirt, manure, and human contamination. The final safeguard is pasteurization.

The same general principles must apply to the production of potable water. The watershed must be protected, insuring that the water will be kept as clean as possible along each step of the route. In addition, the water finally must undergo a degree of treatment consistent with the hazards to which it has been exposed.

Further comparison might be made with fire protection in communities. In the first place, we provide ourselves with regulations concerning construction of our manmade works so that fire hazards are reduced as much as is economically practical. Second, sufficient quantities of water and adequately manned fire-fighting facilities are provided to extinguish any fires which may occur. Finally, there is continuing surveillance and inspection. These examples illustrate the philosophy of providing factors of safety. It is not permissible so to lower factors of safety as to compromise the health and safety of the public.

### Esthetic Considerations

The California State Department of Public Health recently had an inquiry from a person who asked why some of our water supply reservoirs were not open for swimming and bathing. In part, the department replied that the public is unwilling to accept such use of its domestic water supply reservoirs. The interest of the swimming recreationalists, on one hand, and the interest of the water consumer, on the other hand, are incompatible. Under such circumstances the conservative point of view should prevail. Therefore, it is more important to satisfy the esthetic senses of the thousands of water users than to develop unrestricted use of water supply reservoirs which seriously degrades the esthetic quality of the water.

The California State Board of Public Health, in whose hands the legislature has placed the responsibility for granting permits to water purveyors, is limited in its action by the State law which, in section 4016 of the Health and Safety Code, states: "If . . . the board determines, as a fact, that the water furnished or supplied or proposed to be supplied is such that under all the circumstances and conditions it is impure, unwholesome or unpotable or may constitute a menace or a danger to the health or lives of human beings, or the existing or proposed plants, works, system or water supply are unhealthful or insanitary, or not suited to the production or delivery of healthful, pure and wholesome water at all times, it shall deny the permit and order the petitioner to make changes as necessary to secure a continuous sup-

ply of pure, wholesome, potable, and healthful water."

My point in quoting this is to refer to the adjectives "wholesome" and "potable." The State board of public health holds that wholesomeness and potability also include esthetic considerations. When the water-consuming public considers that certain uses of sources of water are repugnant, then it is quite obvious that the water derived from these sources cannot be considered to be wholesome and potable. We must therefore recognize the feelings of the consumers, and we cannot permit uses of their water sources which are esthetically unacceptable. For this reason, the regulations which the State board of health adopted in December 1956 forbid recreational use involving "bodily contact" by man or animals.

## Public Health Considerations

Wherever recreational use of water supplies is undertaken, there must be adequate control, for only with adequate control can such uses be tolerated. There must be assurance that the limits of contamination are not exceeded. Sanitary facilities adequate for the numbers of people in the area must be provided. The facilities must be convenient and they must be esthetically acceptable to the users. This includes their proper maintenance. Last but not least, there must be policing of the people in the area in order to keep their activities within limits consistent with the character of the area in which they are carrying on their recreational activities. The water purveyor must give assurance of this supervision. In addition, the local public health department having jurisdiction over the reservoir must provide appropriate public health supervision.

The State board of public health has considered matters of recreation on water supply reservoirs in the past. In 1951 it granted a permit to the city of San Diego to allow fishing on its reservoirs and in consideration of this action adopted a policy statement concerning recreation on reservoirs. At its meeting on December 7, 1956, the State board of public health formalized this earlier policy statement and adopted regulations on this subject. Problems described above have been taken into account in the regulations, which call for (*a*) limiting the activities of people on the water supply reservoirs; (*b*) providing adequate sanitary facilities for use of the people; (*c*) maintaining these facilities; (*d*) policing the people in the area; and (*e*) providing an adequate degree of treatment of the water derived from these sources.

## Conclusions

1. Water reservoirs may afford a healthful recreational resource for a community.
2. Because water is a vehicle of disease transmission, when a choice must be made between safe water or recreation, safe water must always prevail.
3. Recreational use of water supply reservoirs calls for a high level of supervision and control of people using the area to prevent their wastes from entering the waters.
4. Control of the recreational activities must be adequately budgeted and financed.
5. There must be adequate treatment of water derived from reservoirs.
6. Determination on the basic question of recreational use of water supply reservoirs must be made locally.

We must recognize that permitting such recreational activities constitutes a risk, but that the risk can be minimized to a reasonable and tolerable level if the conditions described are met.

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# Survey of Animal Ringworm in the United States

ROBERT W. MENGES, D.V.M., M.P.H., and LUCILLE K. GEORG, Ph.D.

RINGWORM in animals appears to be sufficiently common in the United States to present a potential public health problem. In August 1953 a study was initiated to determine which fungi were the common causes of ringworm in animals, to obtain data concerning the epizootiology of ringworm, and to determine the role of animals in the spread of infection to man. The plan and the objectives of the study have already been described (*1*), and reviews of the literature on animal ringworm have been published recently (*2*, *3*). This paper summarizes the data accumulated during the 2-year period August 1953 through August 1955.

Veterinarians in 32 States assisted in the study, collecting specimens of hair from domestic, captive, and wild animals. In most of the wild animals, skin lesions were not present.

In the laboratory, all hairs were checked with a Wood's lamp for fluorescence, and, using 10 percent potassium hydroxide, a direct microscopic examination for fungus elements was made. Following this preliminary examination, the hairs were cultured on cycloheximide medium (*4*) and held at 25° C. for a minimum of 1 month before being discarded as negative.

Specimens of hair from 1,073 domestic animals were cultured. Dermatophytes were isolated from 277, or 26 percent. A summary of these results is presented in table 1. In addition, hair specimens from 1,465 wild and captive animals were cultured, and dermatophytes were isolated from 243, or 17 percent (table 2). Thus, a total of 2,538 specimens of animal hair were cultured and dermatophytes were isolated from 520, or 20 percent. Figure 1 shows the distribution of the study animals and the number positive for ringworm.

Five different pathogenic organisms were identified among the animal isolates. These included *Microsporum canis* from cats, dogs, monkeys, and a chinchilla; *Microsporum gypseum* from dogs, mice, and rats; *Trichophyton mentagrophytes* from dogs, chinchillas, guinea pigs, a kangaroo, mice, rats, and an opossum; *Trichophyton equinum* from horses; and *Trichophyton verrucosum* from cattle and a burro. In addition, a variety of *M. gypseum* which was designated *M. gypseum* (red variety) was isolated from rats and mice. Dr. L. Ajello, of the Communicable Disease Center's Mycology Unit, describes this variety as a new species. A similar organism has been isolated from soil obtained from Idaho and Washington by Cooke (*5*), from Michigan by Ajello, and from Georgia by Menges (*6*).

Lesions were found in 408 of the 520 animals with ringworm. Scaling, circular lesions with alopecia were most common. The most common locations of the lesions were the head, the neck, and the leg.

The animal hairs were examined by culture, by direct microscopic examination, and by Wood's lamp for fluorescence. Of 290 cases which were positive by culture, only 117 (40 percent) were positive by direct microscopic

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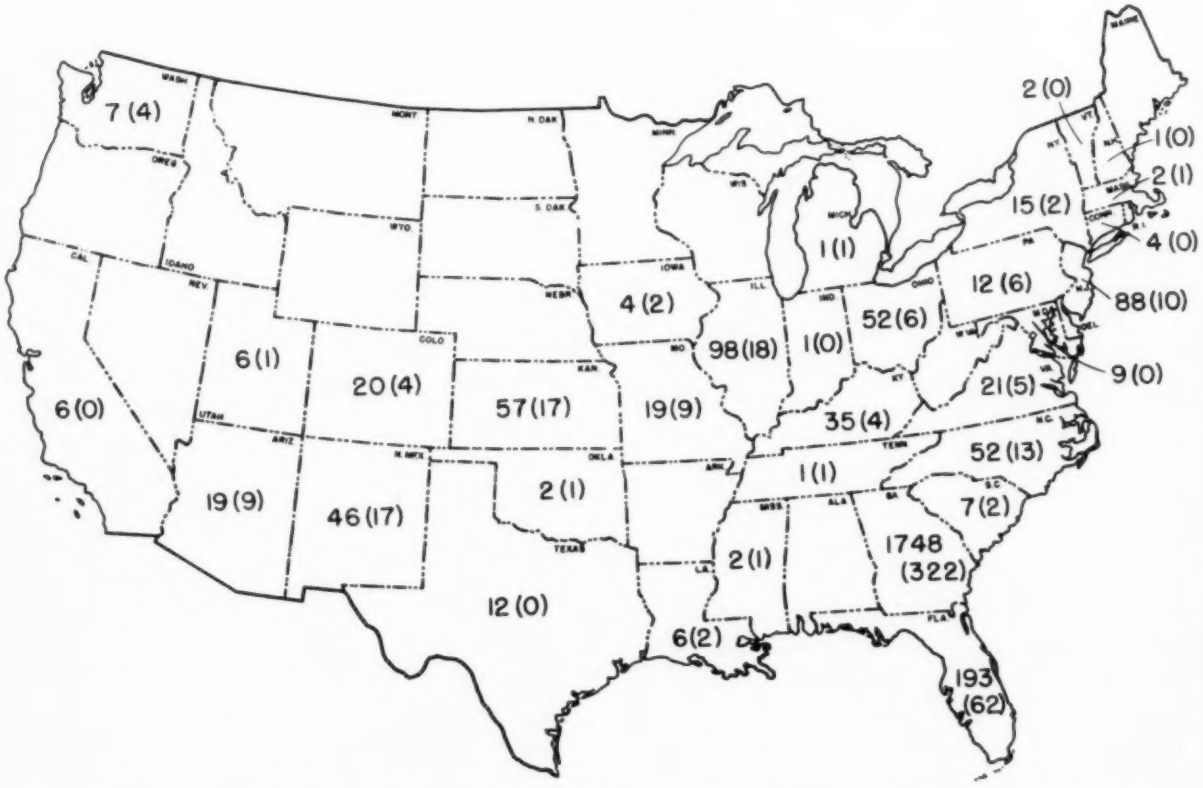
**Table 1. Cultural results with domestic animal specimens**

| Animal and organism isolated | Specimens cultured | | | | | |
|---|---|---|---|---|---|---|
| | Total | | | No lesions | | |
| | Number cultured | Positive | | Number cultured | Positive | |
| | | Number | Percent | | Number | Percent |
| Cat (*Microsporum canis*) | 281 | 125 | 45 | 92 | 23 | 25 |
| Cattle (*Trichophyton verrucosum*) | 105 | 21 | 20 | 61 | 0 | 0 |
| Chicken [1] | 2 | | | 2 | 0 | 0 |
| Dog | 641 | 127 | 19. 8 | 193 | 1 | . 5 |
| *Microsporum canis* | (641) | 77 | 12 | 1 | 1 | 100 |
| *Microsporum gypseum* | (641) | 46 | 7. 2 | | | |
| *Trichophyton mentagrophytes* | (641) | 4 | . 6 | | | |
| Horse (*Trichophyton equinum*) | 29 | 3 | 10 | 11 | 0 | 0 |
| Burro (*Trichophyton verrucosum*) | 1 | 1 | 100 | | | |
| Mule [1] | 2 | 0 | 0 | 2 | 0 | 0 |
| Sheep [1] | 1 | 0 | 0 | | | |
| Goat [1] | 1 | 0 | 0 | | | |
| Swine [1] | 10 | 0 | 0 | 8 | 0 | 0 |
| Total | 1, 073 | 277 | 26 | 369 | 24 | 7 |

[1] No isolations.

**Figure 1. Distribution of ringworm cases in animals in 32 States participating in survey, August 1953 to September 1955.**




NOTE: Figures indicate number of animals cultured; figures in parentheses, number of positive cultures.

examination and 46 (16 percent) by Wood's lamp. These results emphasize the value of cultures in diagnosing ringworm infections since *Trichophyton*-infected hairs usually do not fluoresce and infected hairs may be overlooked in direct examination.

### Human Contacts

An attempt was made to gather evidence of the development of skin lesions in human beings in homes where infected animals were kept. A history of such lesions was found in 59, or 31 percent, of 192 families in homes in which 252 infected dogs and cats were kept. Presumptive ringworm was found in 14 of 120 (12 percent) of the families associated with canine cases and in 45 of 72 (63 percent) of the families associated with feline cases. This information was obtained from the owners of infected animals by the veterinarians who attended the animals and by followup studies.

Thirty-four human outbreaks were thought to be caused by infected cats and only 12 out-

**Table 2. Results of culturing specimens of hair from wild and captive animals**

| Animal and organism isolated | Specimens cultured | | | | |
|---|---|---|---|---|---|
| | Total | | | No lesions | |
| | Number cultured | Positive | | Number cultured | Positive |
| | | Number | Percent | | Number | Percent |
| Bat [1] | 1 | 0 | 0 | 1 | | |
| Bird [2] | 3 | 0 | 0 | 2 | | |
| Bobcat [1] | 2 | 0 | 0 | 2 | | |
| Cheetah [1] | 1 | 0 | 0 | | | |
| Cat [1] | 4 | 0 | 0 | 4 | | |
| Chinchilla | 40 | 7 | 17. 5 | 21 | 0 | 0 |
| *Microsporum canis* | (40) | 1 | 2. 5 | 0 | | |
| *Trichophyton mentagrophytes* | (40) | 6 | 15. 0 | 0 | | |
| Fox [1] | 7 | 0 | 0 | 7 | | |
| Gerbil [1] | 26 | 0 | 0 | 26 | | |
| Guanaco [1] | 1 | 0 | 0 | 1 | | |
| Guinea pig (*T. mentagrophytes*) | 200 | 141 | 71. 0 | | | |
| Hamster [1] | 1 | 0 | 0 | | | |
| Jerboa [1] | 16 | 0 | 0 | 16 | 0 | 0 |
| Kangaroo (*T. mentagrophytes*) | 1 | 1 | 100. 0 | | | |
| Meriones [1] | 12 | 0 | 0 | 8 | 0 | 0 |
| Mice [3] | 546 | 53 | 9. 7 | 545 | 53 | 9. 7 |
| *Microsporum gypseum* | (546) | 2 | . 4 | (545) | 2 | . 4 |
| *Microsporum gypseum* (red variety) | (546) | 36 | 6. 5 | (545) | 36 | 6. 5 |
| *Trichophyton mentagrophytes* | (546) | 15 | 2. 8 | (545) | 15 | 2. 8 |
| Mink [1] | 1 | 0 | 0 | | | |
| Monkey (*M. canis*) | 8 | 6 | 75. 0 | 2 | 0 | 0 |
| Opossum (*T. mentagrophytes*) | 59 | 1 | 2. 0 | 59 | 1 | 2 |
| Rabbit [1] | 11 | 0 | 0 | 7 | 0 | 0 |
| Raccoon [1] | 42 | 0 | 0 | 42 | 0 | 0 |
| Rat [4] | 471 | 34 | 7. 2 | 455 | 34 | 7. 4 |
| *Microsporum gypseum* | (471) | 2 | . 4 | (455) | 2 | . 4 |
| *Microsporum gypseum* (red variety) | (471) | 11 | 2. 3 | (455) | 11 | 2. 4 |
| *Trichophyton mentagrophytes* | (471) | 21 | 4. 5 | (455) | 21 | 4. 6 |
| Skunk [1] | 2 | 0 | 0 | 2 | 0 | 0 |
| Squirrel [1] | 8 | 0 | 0 | 8 | 0 | 0 |
| Woodchuck [1] | 2 | 0 | 0 | 2 | 0 | 0 |
| Total | 1, 465 | 243 | 17. 0 | 1, 210 | 88 | 7. 2 |

[1] No isolations.

[2] Canary, western evening grosbeak (*Hesperiphona vespertina*), warbler (unknown species).

[3] *Mus musculus, Peromyscus gossypinus, Peromyscus nuttalli, Pitymys pinetorum, Peromyscus polionotus, Rheithrodontomys humulis.*

[4] *Sigmodon hispidus, Rattus rattus, Rattus norvegicus, Neotoma floridans.*

breaks, by infected dogs. The number of individuals involved in any one outbreak varied from 1 to 16; the total number of suspected cases was 107. The outbreaks occurred in 16 States (fig. 2).

### Infections in Dogs

Specimens of hair from 641 dogs were cultured; 127 dogs (19.8 percent) had ringworm. *M. canis* was isolated from 77 (12 percent), *M. gypseum* from 46 (7.2 percent) and *T. mentagrophytes* from 4 (0.6 percent). *Keratinomyces ajelloi* was isolated from a 4-year-old male fox terrier from New Jersey with suppurative lesions on its head. *K. ajelloi*, however, has not been proved to be a pathogen.

Thirty-nine percent of the dogs under 1 year of age were positive for ringworm (table 3). This percentage decreased with age; only 1 percent were positive in dogs 7 years of age and over.

There did not appear to be a marked difference in susceptibility between the sexes; 78 (23 percent) of 342 males and 49 (17 percent) of 281 females were positive.

The data on breed group and age were too scanty to determine definite differences in susceptibility to ringworm; however, the data indicated that all breed groups were involved. Breeds were grouped according to the American Kennel Club classification. In the groups aged 1 and 2 years, the percentages positive were quite similar, possibly indicating that the breed of the animal is not an important factor in susceptibility to infection.

Twenty-two (14 percent) of 152 dogs cultured in the spring were positive, 43 (19 percent) of 227 cultured in the summer, 35 (22 percent) of 159 cultured in the fall, and 27 (26 percent) of 103 cultured in the winter. January was the peak month, with 10 (30 percent) of the 33 cultures positive.

Only 14 (11 percent) of the 127 canine cases of ringworm were found in rural areas. Six (7.7 percent) of the *M. canis* cases and 8 (17.3

**Figure 2. Distribution of 46 outbreaks of suspected cases of ringworm in man associated with cases of ringworm in dogs and cats, August 1953 to September 1955.**

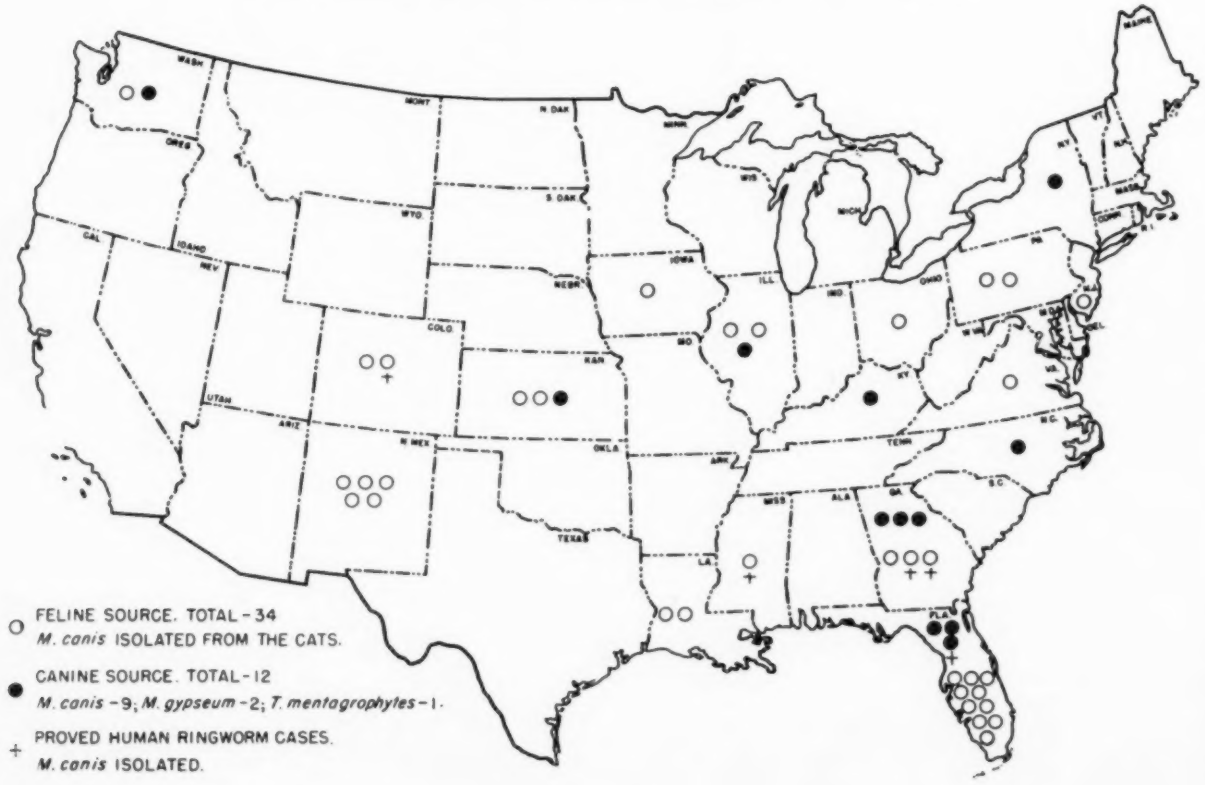


**Table 3. Age distribution of 641 dogs infected with ringworm**

| Age (years) | Number examined | Positive | |
|---|---|---|---|
| | | Number | Percent |
| Under 1 | 181 | 71 | 39 |
| 1–2 | 171 | 39 | 23 |
| 3–4 | 120 | 11 | 9 |
| 5–6 | 69 | 5 | 7 |
| 7 and over | 79 | 1 | 1 |
| Unknown | 21 | 0 | 0 |
| Total | 641 | 127 | 20 |

percent) of the *M. gypseum* cases were in rural areas.

Outbreaks of ringworm among groups of dogs were not common. Only one *M. canis* outbreak and two *M. gypseum* outbreaks were found in this study. All of the outbreaks occurred among litter mates.

### Infections in Cats

Outbreaks of ringworm among cats were much more common than outbreaks among dogs. Ten outbreaks among cats were found in the survey; six of these occurred in breeding establishments.

Specimens of hair from 281 cats were cultured and *M. canis* was isolated from 125 (45 percent) of these. *M. canis* was the only dermatophyte isolated.

The age distribution of the cats is shown in table 4. Sixty-seven percent of the cats under 1 year of age had ringworm. Although the percentage of positive cats decreased with age, ringworm was found in cats of all ages.

There did not appear to be a marked difference in susceptibility to ringworm between the sexes. Fifty-seven (40 percent) of 144 males cultured, and 64 (49 percent) of 130 females cultured were positive. In the group under 1 year of age, 36 (68 percent) of 53 males and 34 (64 percent) of 53 females were positive. In the group aged 1–2 years, 13 (30 percent) of 44 males and 14 (34 percent) of 41 females were positive.

The data on breed and age were scanty, but there appeared to be a difference in the percentage of infections in purebred cats and in cats of mixed breed. This difference may indicate either that ringworm is apt to develop more readily among groups of cats confined in breeding establishments or that purebred cats are more susceptible to ringworm than other types of cats.

The peak months for the occurrence of ringworm among cats were September, October, and November. However, the numbers of cases are too few to admit of any definite conclusions. An analysis of the data according to season showed that 9 (21 percent) of 43 cats cultured in the spring were positive, 38 (37 percent) of 103 cultured in the summer, 67 (71 percent) of 94 cultured in the fall, and 11 (27 percent) of 41 cultured in the winter.

Only 2 (1.6 percent) of the 125 feline cases occurred in rural areas.

### Infections in Cattle and Horses

Specimens of hair from 105 cattle were cultured and *T. verrucosum* was isolated from 21 (20 percent). *T. verrucosum* was the only dermatophyte isolated. The 21 cases were from 10 States and represented 14 herds of cattle.

The age distribution of the infected cattle was as follows:

| *Age (years)* | *Number examined* | *Positive* | |
|---|---|---|---|
| | | *Number* | *Percent* |
| 2 and under | 45 | 18 | 40 |
| 3–4 | 23 | 1 | 4 |
| 5–6 | 20 | 1 | 5 |
| 7 and over | 6 | 0 | 0 |
| Unknown | 11 | 1 | 9 |

The ringworm cases occurred among both dairy and beef cattle, including Hereford,

**Table 4. Age distribution of 281 cats infected with ringworm**

| Age (years) | Number examined | Positive | |
|---|---|---|---|
| | | Number | Percent |
| Under 1 | 109 | 73 | 67 |
| 1–2 | 88 | 28 | 32 |
| 3–4 | 42 | 16 | 38 |
| 5–6 | 16 | 3 | 19 |
| 7 and over | 17 | 5 | 29 |
| Unknown | 9 | 0 | 0 |
| Total | 281 | 125 | 45 |

Aberdeen Angus, Brahman-Hereford cross, Jersey, Guernsey, and Holstein.

The disease occurred among cattle on the range, in feed lots, and on small dairy farms. In some outbreaks, 25 to 50 percent of the animals had skin lesions. The number of isolations reported does not represent the total number of cases of ringworm in the 14 herds.

Although there was no history of human infections among the individuals associated with the infected cattle, such transmission has been reported in the United States (*7*).

Specimens of hair from 29 horses were cultured and *T. equinum* was isolated from 3 (10 percent) : a saddle horse from Florida, a Tennessee walking horse from Ohio, and a thoroughbred horse from New Jersey. A recent study of ringworm of the horse by Georg and co-workers (*8*), with special reference to *T. equinum*, emphasizes that *T. equinum* is distinct from *T. mentagrophytes*.

### Infections in Captive and Wild Animals

The organism most commonly isolated from captive animals was *T. mentagrophytes*. This organism was isolated from 6 chinchillas, 141 guinea pigs, and a kangaroo. *M. canis*, which appeared to be prevalent among monkeys, was isolated from 6 of 8 monkeys from Florida. *M. canis* was also isolated from one chinchilla.

Most of the specimens of hair from wild animals were obtained through a cooperative study on ringworm which was carried on with the Communicable Disease Center's Newton Field Station, Newton, Ga. Only 16 of 1,142 specimens from southern Georgia were from wild animals with skin lesions. The 1,142 specimens of hair were from 21 species of wild animals (table 2). Dermatophytes were isolated from 88 wild animal specimens (7.7 percent) from southern Georgia.

The organisms isolated from wild animals were: *M. gypseum*, *M. gypseum* (red variety), and *T. mentagrophytes*. The "red variety" of *M. gypseum* differed from the typical *M. gypseum* since the macroconidia had thicker walls and the colony developed a deep blood-red pigment in the agar. The red variety of *M. gypseum* was frequently isolated from cotton rats and field mice.

### Discussion

Cats and dogs appear to be important transmitters of ringworm infection to man. Cattle are also of significance in this respect; however no evidence of human contagion from this source was found in this survey. A recent report by Torres and co-workers indicates that chickens may transmit ringworm infection (*9*).

*M. canis* was most commonly transmitted to man by cats or dogs. The young kitten with ringworm lesions was suspected of being the most frequent source of human outbreaks. Since there is no evidence that *M. canis* exists as a saprophyte in nature, it would appear that control of *M. canis* ringworm infections in the cat and dog would prevent *M. canis* infection in man. To accomplish this, at least two measures would be needed: (*a*) the control of breeding establishments and (*b*) the elimination of stray dogs and cats. Such a program has been developed by La Touche in Leeds, England, and has met with notable success (*10*).

The three cases of equine ringworm diagnosed in this survey were caused by *T. equinum*. This fungus is of particular interest, for hitherto it has not been recognized as a distinct species in this country. A study of equine ringworm by Georg and co-workers (*8*) has established that this organism, commonly associated with the horse, is a distinct species and should not be considered to be merely a variety of *T. mentagrophytes*.

The survey of wild animals revealed that ringworm caused by *T. mentagrophytes* is apparently common among rodents. It is interesting that these animals harbor this fungus without demonstrating any clinical signs of infection. The fact that the greatest number of infections occurred among rats which frequented barns and farm premises suggests that these animals may be a source of *T. mentagrophytes* infections in human populations in rural areas. It would not appear to be necessary for human beings to have direct contact with rats in order to acquire infection since it has been found that dermatophytes on hairs or skin scales may remain viable for many months. It is probable that certain areas of farm premises, especially feed bins and barns, may be contaminated by spores and infected hairs shed by ro-

dents. Because of their ubiquity and abundance, rodents would constitute a more likely source of human infection than the occasional infected dog or other farm animal.

Second to *M. canis*, *M. gypseum* appears to be the most common cause of ringworm among dogs in the United States. Verification of 46 cases during the 2-year period of this survey was quite surprising since this type of ringworm had previously been thought to be rare in animals. The recently acquired knowledge that *M. gypseum* is a common soil saprophyte (*11*), however, suggests that infection should be common in animals. The supposed rarity of *M. gypseum* infections is probably due to the fact that cultures are seldom made from animals suspected of having ringworm.


## Summary

In a survey of domestic, captive, and wild animals for ringworm, dermatophytes were isolated from 520 (20 percent) of the 2,538 hair specimens cultured. The organisms commonly isolated were *Microsporum canis* from cats, dogs, monkeys, and a chinchilla; *Microsporum gypseum* from dogs, mice, rats; *Trichophyton mentagrophytes* from dogs, horses, chinchillas, guinea pigs, mice, rats, a kangaroo, and an opossum; and *Trichophyton verrucosum* from cattle and a burro. Data are presented concerning the frequency of skin lesions, method of diagnosis, and the epizootiological aspects of canine and feline ringworm. The results indicate that ringworm is a common disease among animals in the United States.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## National Health Survey Launched

On May 6, 1957, interviewers in the National Health Survey began visiting selected households throughout the Nation to collect information on illness, accidents and injuries, disability, hospitalization, and medical and dental care.

The survey, which will be continuous, was authorized by the 84th Congress. The household interviewing is being done for the Public Health Service by the Bureau of the Census; it represents the first effort in 20 years to collect such facts comprehensively.

The National Health Survey is also planning methodological and special studies to collect data not obtainable through household interviewing.




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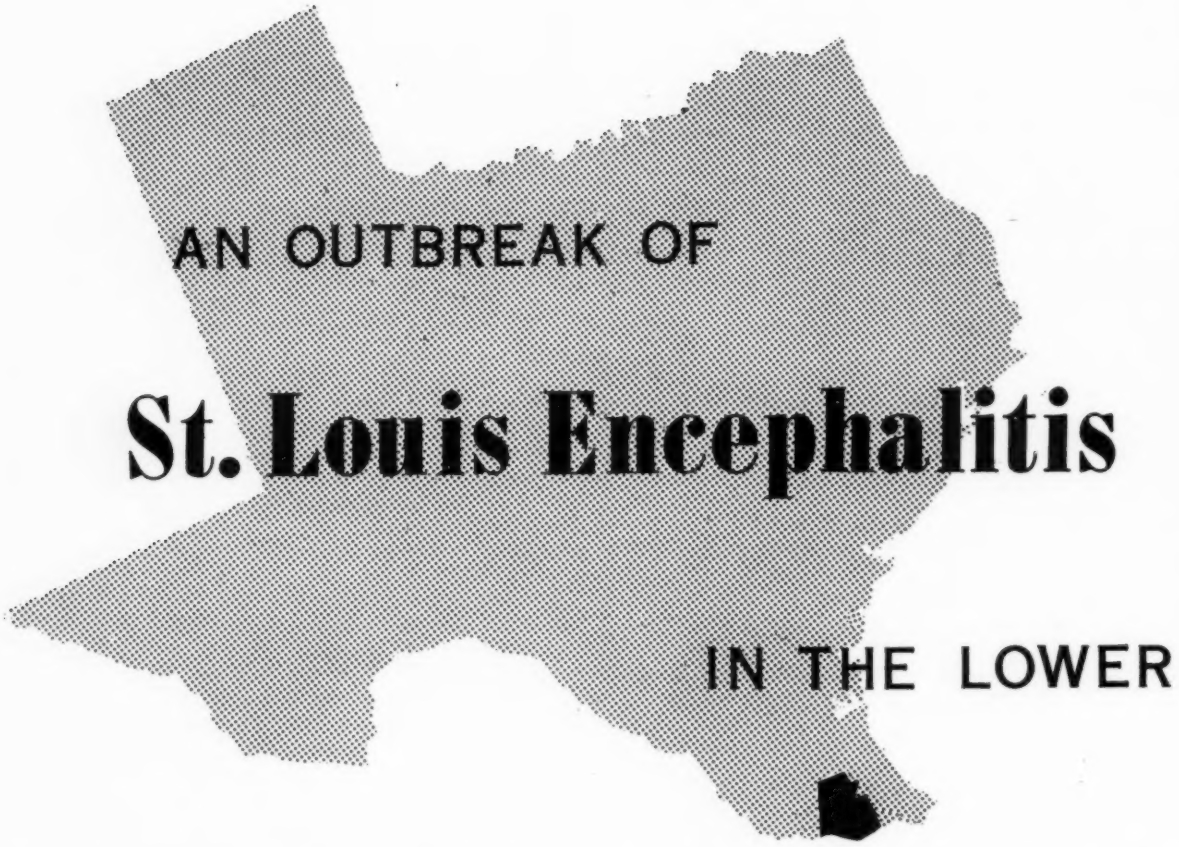


THE intensive study of an outbreak of St. Louis encephalitis in the Lower Rio Grande Valley of Texas in 1954 is covered comprehensively in the four papers that follow. They present the epidemiological aspects of the outbreak, the clinical and pathological features, the laboratory phases of the work, and the entomological studies and vector control operations.

The outbreak is one of the largest that has been recorded for this viral disease and represents a new geographic area of distribution.

The study was a joint undertaking of the Hidalgo County (Tex.) Health Unit, the Texas State Department of Health, and the Communicable Disease Center of the Public Health Service. At the time of the study, Dr. Theodore J. Bauer, now deputy chief, Bureau of State Services, Public Health Service, was chief of the Communicable Disease Center. Dr. Henry A. Holle was commissioner of health of the Texas State Department of Health, and Dr. Charles H. Miller, Jr., the director of the Hidalgo County Health Unit (now director, Comanche County Health Department, Oklahoma).

According to Drs. Bauer, Holle, and Miller, the study helped establish *Culex quinquefasciatus* as the natural vector of the St. Louis encephalitis virus. It also gave recognition, probably for the first time, to the prevalence and probable importance of mild and inapparent infections.

In reviewing other outbreaks of the illness, they point out that this virus disease has been recognized a relatively short time. In 1932 an outbreak of an obscure illness in Paris, Ill., and a similar, more extensive outbreak the next year in the St. Louis, Mo., area prompted an intensive investigation. As a result of this study, the disease entity, now known as St. Louis encephalitis, was defined and the etiological agent identified. Though transmission by mosquitoes was suspected, it was ruled out at that time. Retrospective studies, however, have led to acceptance of *Culex pipiens-quinquefasciatus* as the transmitting agent in this epidemic.

Again in 1937 an outbreak occurred in St.

# RIO GRANDE VALLEY OF TEXAS IN 1954

Louis, and since then sporadic cases and small outbreaks have been recognized, particularly in California. Subsequent to this study, there have been large outbreaks in the lower Ohio River Valley, 1955, and in the Texas Panhandle and the Louisville, Ky., areas, 1956.

Reporting of this disease, however, is never sufficient except during recognized outbreaks, and even then few cases with adequate followup are described. As a result, the true scope of incidence and geographic distribution has never been defined and the range and severity are inadequately known.

This disease represents only one segment of the larger human disease category of acute infectious encephalitis. The two other distinct viruses indigenous to the United States are western equine and eastern equine encephalitis. Essentially the same limitations exist in the accumulated knowledge pertaining to each. Until there is better understanding of the basic ecology of the viral encephalitides, the full extent of the public health problem cannot be known. But it is known that the viruses are transmitted to a reservoir of wild birds by mosquitoes, with a vector occasionally making man and the other larger mammals accidental hosts. Present knowledge indicates that control of encephalitis rests primarily with the control of the particular vector mosquito species.

The outbreak described here occurred late in 1954 in a semitropical area of Texas where the climate and topography especially favor mosquito production. In the spring of that year unusually heavy rains created large residual pools of water that stood for varying periods of time. Hidalgo County and the surrounding area bore the burden of the grave mosquito breeding problem that followed. The Governor declared a state of emergency in this county, and intensive mosquito control operations were conducted. By early May it appeared that adult mosquito populations had been reduced to negligible levels.

In late August an unusually large number of cases of poliomyelitis were reported from the area, many involving adults. This unusual seasonal incidence and the atypical age distribution cast doubt as to the true etiology of the illness. An intensive investigation followed, and St. Louis encephalitis was identified.

# Epidemiological Features

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DURING the late summer of 1954, an outbreak of illness subsequently identified as St. Louis encephalitis occurred in the Lower Rio Grande Valley of Texas.

The existence of a viral encephalitis in epidemic form was first suspected by the local health authorities in the latter part of August, when an unusually large number of cases of poliomyelitis were reported from Hidalgo County. It was noted that a large proportion of the cases were in adults. In view of this unusual seasonal incidence, together with the atypical age distribution, a disease entity other than poliomyelitis was suspected.

On August 24 a request for epidemiological aid was submitted to the Communicable Disease Center of the Public Health Service by the Texas State Department of Health. A CDC team consisting of epidemiologists, entomologists, and a statistician was sent to the scene of the epidemic to aid in the investigation. Records on 373 cases, 10 of them fatal, were obtained from Hidalgo and adjoining counties.

Hidalgo County is in the Lower Rio Grande Valley of Texas (see map, p. 511). The economy of the area is based upon agriculture carried on in the irrigated, highly fertile, southern part of the county bordering the Rio Grande River. Citrus, cotton, and truck produce are the primary crops. Canning and oil and gas production are also important industries. The northern part of the county is sparsely settled ranch country and contains only a small portion of the population.

The residents of the area may be divided into two major ethnic groups, namely, Latin-American and Anglo-American. The Latin-Americans are of Mexican and Spanish descent, while the term Anglo-American applies to the remainder of the population with the exception of small Negroid and Asiatic components. The Latin-Americans are largely unskilled and semiskilled laborers, often employed only during periods of agricultural labor demand. In many instances their housing is inadequate and crowded, and sanitation is poor. The two groups generally live in separate sections of the urban communities.

There are also a number of Mexican nationals, engaged primarily in agricultural labor, living in the valley. These include the *braceros*, laborers who enter the country under Government supervision, and many "wetbacks" who have entered the country illegally in search of higher wages. The *braceros* live in closely supervised camps and remain in this country only for a specified period as dictated by agricultural need and labor contract provisions. The "wetbacks" often are semipermanent residents of the area, their periods of tenure being limited only by detection and deportation by the border patrol. They live in whatever housing they can find, usually under extremely primitive and crowded conditions.

The population of the county, according to the 1950 decennial census, was 160,446; 57 per-

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cent urban, 23 percent rural nonfarm, and 20 percent rural farm. Local sources state that the population was approximately 69 percent Latin-American, 30 percent Anglo-American, and less than 0.4 percent Negro. The population increased 51.3 percent from 1940 to 1950. The 1954 population of Hidalgo County was estimated to be 193,369.

### Meteorological Data

During the period April 8–14, 1954, heavy rains averaging 10 inches fell over a large area within the county, exceeding by 6 inches the maximum rainfall recorded for the same month during the period 1940 through 1953. Because of poor drainage in this area, the water persisted for quite some time and provided excellent mosquito breeding conditions. The mosquito population, however, was kept down by vector control operations. Precipitation in June, July, August, and September was within normal limits.

Temperatures during the spring were normal, averaging about 75° F. June was the hottest month on record for the period 1940–54; the average temperature was 87.8° F. From July through September the temperatures were within the normal range.

### Investigation Methods

The investigation was a joint operation of the Hidalgo County Health Unit, the Texas State Department of Health, and the Public Health Service. On August 27, shortly after the arrival of the epidemiological team, a preliminary appraisal of the epidemic situation was accomplished through a telephone survey to local physicians. This definitely established the existence of an unusual prevalence of a disease resembling virus encephalitis. After this preliminary survey, forms for systematic collection of clinical and epidemiological data were prepared. A meeting was then held with the representatives of the local medical society for the purpose of obtaining cooperation in the prompt and accurate reporting of cases. Physicians were also encouraged to submit a list of patients that they had previously seen and suspected of having had encephalitis, and to obtain blood specimens from all new patients during the acute phase of the illness. Investigators visited these physicians periodically in order to collect data on new cases. They also visited local hospitals and patients at home during convalescence to obtain more complete epidemiological data.

Only one hospital in this area was available for treatment of poliomyelitis, and all cases diagnosed as having poliomyelitis were admitted there. Owing to the difficulty of differentiating nonparalytic poliomyelitis from encephalitis clinically, one epidemiologist was assigned to this hospital to study the cases admitted and to review the hospital records. Many of the cases admitted there during this epidemic period were subsequently found to have encephalitis rather than poliomyelitis.

Paired serum samples from 87 patients and single serums from 50 individuals giving a history of no illness were collected for antibody determination. Three autopsies were performed, and brain tissues from two were taken for virus study. All specimens were sent to the bureau of laboratories of the Texas State Department of Health. In addition, brain tissues were sent to the Virus and Rickettsia Section, Communicable Disease Center, for virus isolation.

In a diligent search for potential vectors, the entomologists emphasized collection of adult mosquitoes for virus isolation.

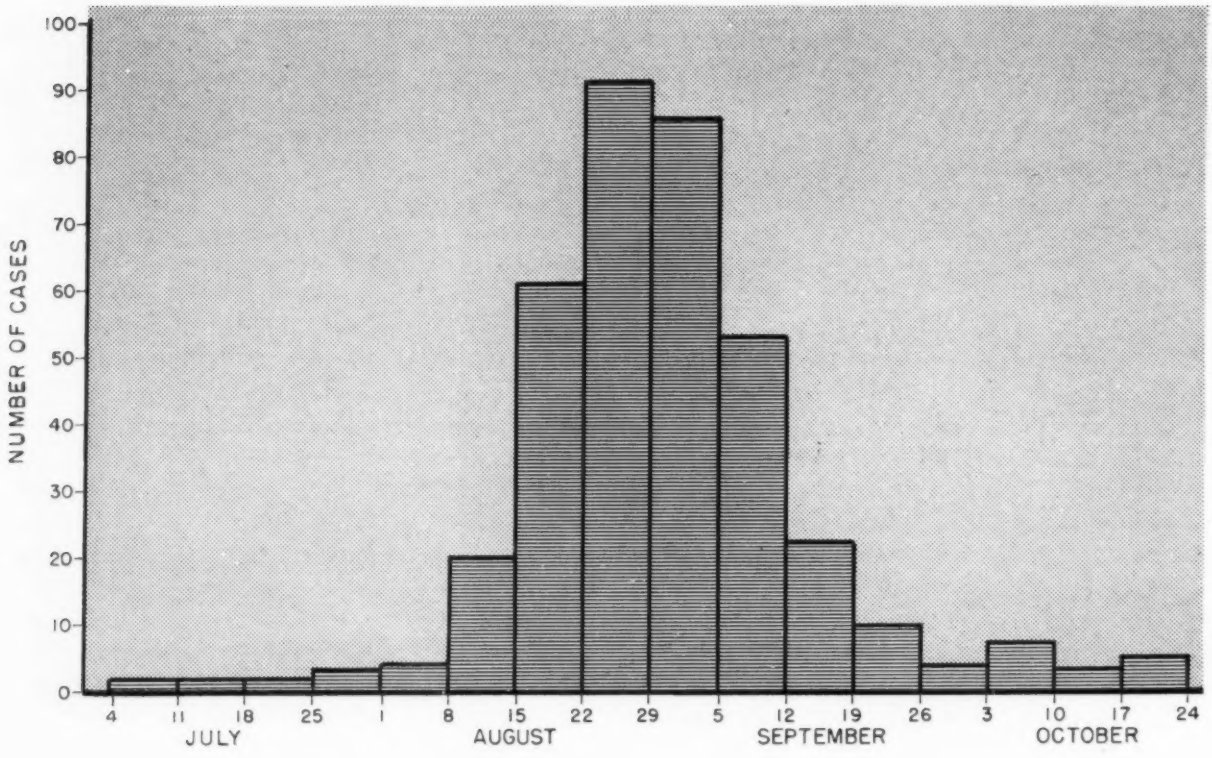
Local veterinarians were also contacted to ascertain whether there were any known outbreaks of disease in animals, and any notifications of unusual disease in animals were investigated by the veterinarian epidemiologist.

### Results

In general, the disease was an acute febrile illness characterized by a relatively abrupt onset, with fever, severe generalized headache, malaise, disorientation, stupor, and signs of meningeal irritation. The course was usually self-limited, with the fever lasting 3 to 7 days, falling by lysis.

During early July physicians began to notice an increase in the number of patients with fever of unknown origin. In retrospect, these cases could have been mild encephalitis and probably represented the beginning of the epi-

**Figure 1. Distribution of 363 reported cases by week of onset, Hidalgo County, Tex., 1954.**




demic. In August an increasing number of cases were observed, and the outbreak reached its peak during the last week of the month. Figure 1 depicts the epidemic curve of the 363 cases for which date of onset was available. The dates of onset of the other 10 cases were not recorded. It is of interest that most of the cases occurred during the period from the middle of August to the middle of September.

Based on the 317 cases for which data were available and on the estimated 1954 population, the attack rate for Hidalgo County was 163.9 per 100,000. It was felt that many patients with symptoms of mild encephalitis were not seen by physicians and consequently had not been reported. Further, during the early phase of the epidemic many of the cases diagnosed as encephalitis were not reported to the health department. Based on the number obtained by the telephone survey and on the number of cases actually reported, it was estimated that approximately 2.8 times as many cases had occurred as were actually reported, or a total of approximately 1,000 cases.

Of 11 towns in this area with a population greater than 1,000, the attack rate was highest in Weslaco and lowest in Mercedes (table 1). The cases occurred in widely separated areas and there was no evidence of radial spread from one town to another. Although all age groups were affected, the incidence was highest in individuals over 50 years of age (table 2). The incidence for males was 155.7 per 100,000

**Table 1. Number of cases and attack rates for cities with more than 1,000 population, Hidalgo County, Tex., 1954**

| City | Estimated 1954 population | Number of cases | Rate per 100,000 |
|---|---|---|---|
| Weslaco | 9,056 | 39 | 430.6 |
| San Juan | 4,113 | 12 | 291.8 |
| Edinburg | 14,924 | 37 | 247.9 |
| Edcouch | 3,525 | 6 | 170.2 |
| Alamo | 3,636 | 7 | 192.5 |
| Elsa | 3,831 | 7 | 182.7 |
| McAllen | 24,185 | 44 | 181.9 |
| Pharr | 10,473 | 17 | 162.3 |
| Mission | 12,974 | 17 | 131.0 |
| Donna | 8,642 | 7 | 81.0 |
| Mercedes | 12,150 | 3 | 24.7 |

**Table 2. Number of cases and attack rates by age and sex for 317 residents of Hidalgo County, Tex., late summer 1954**

| Age | Estimated 1954 population | | | Number of cases | | | Attack rate per 100,000 | | |
|---|---|---|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total | Male | Female | Total |
| Under 9 | 27, 268 | 26, 437 | 53, 705 | 37 | 17 | 54 | 135. 7 | 64. 3 | 100. 5 |
| 10–19 | 18, 484 | 17, 593 | 36, 077 | 20 | 21 | 41 | 108. 2 | 119. 4 | 113. 6 |
| 20–29 | 17, 614 | 16, 762 | 34, 376 | 18 | 20 | 38 | 102. 2 | 119. 3 | 110. 5 |
| 30–39 | 13, 182 | 11, 992 | 25, 174 | 17 | 29 | 46 | 129. 0 | 241. 8 | 182. 7 |
| 40–49 | 10, 348 | 9, 050 | 19, 398 | 6 | 20 | 26 | 58. 0 | 221. 0 | 134. 0 |
| 50–59 | 6, 202 | 5, 889 | 12, 091 | 16 | 11 | 27 | 258. 0 | 186. 8 | 223. 3 |
| 60–69 | 3, 960 | 3, 812 | 7, 772 | 13 | 20 | 33 | 328. 3 | 524. 6 | 424. 6 |
| 70 and over | 2, 478 | 2, 298 | 4, 776 | 13 | 14 | 27 | 524. 6 | 609. 2 | 565. 3 |
| Unknown | | | | 15 | 10 | 25 | | | |
| Total | 99, 536 | 93, 833 | 193, 369 | 155 | 162 | 317 | 155. 7 | 172. 6 | 163. 9 |

and for females, 172.6. In the 0- to 9-year age group, the attack rate in males, 135.7, was roughly twice that of 64.3 for females; in the 40- to 49-year age group only 6 cases were reported in males, giving an attack rate of 58 as compared with 221 for females.

The rate for the Anglo-American population was more than three times that for the Latin-American (table 3). It is quite possible that some of the cases included in the Latin-American group were actually Mexican nationals. This, if true, would tend to strengthen the observed difference. On the other hand, it is quite certain that reporting was less accurate among the Latin-Americans than among the Anglo-Americans, and this would tend to diminish the observed difference in the incidence. The attack rate for the *braceros*, based on a very rough population estimate, appeared about midway between the two racial groups. It may also be stated that *braceros* were covered by compulsory medical insurance and generally were hospitalized. This resulted in more accurate reporting than might have been expected in this group.

The rural-urban distribution of the reported cases in Hidalgo County showed a higher attack rate in the urban population than in the rural (table 4).

For entomological studies, approximately 2,000 adult mosquitoes were collected by light traps, hand collections in shelters, and biting collections. Representative samples of larvae were collected from temporary and permanent water. It was found that *Psorophora confinnis* was predominant in the temporary water habitats. However, in artifical containers around premises, *Culex quinquefasciatus* was found breeding in significant numbers. This species was predominant among mosquitoes collected in shelters; it formed a large percentage of those obtained from biting collections, and about 14 percent of the mosquitoes collected by light traps. *P. confinnis* was the preponderant species among those caught by the latter method.

The virus of St. Louis encephalitis was isolated from brain tissues of one fatal case of encephalitis as well as from two pools of *C. quinquefasciatus* mosquitoes. A fourfold or greater rise of complement-fixing antibodies for St. Louis encephalitis was demonstrated on 43.7 percent of the patients. Seventy percent of the individuals who presumably were exposed but had no clinical illness also had complement-fixing antibodies for this disease.

No detailed studies on possible reservoirs of infection were made in animals during this epi-

**Table 3. Number of cases and attack rates by ethnic group, Hidalgo County, Tex., 1954**

| Ethnic group | Estimated 1954 population | Number of cases | Rate per 100,000 |
|---|---|---|---|
| Anglo-American | 59, 944 | 191 | 318. 4 |
| Latin-American | 133, 424 | 126 | 94. 4 |
| *Bracero* | [1] 12, 000 | 23 | 191. 7 |
| Other | | 1 | |
| Unknown | | 2 | |

[1] Estimated number of *braceros* in the county during the outbreak.

**Table 4. Number of cases and attack rates by rural-urban classification, Hidalgo County, Tex., 1954**

| Classification | Estimated 1954 population | Number of cases | Rate per 100,000 |
|---|---|---|---|
| Urban residents | 110, 800 | 191 | 178. 7 |
| Rural residents | 96, 569 | 114 | 110. 2 |
| Unknown | | 31 | |

demic. However, preliminary investigation showed no known epizootics occurring concurrently with the epidemic or during the spring and summer.

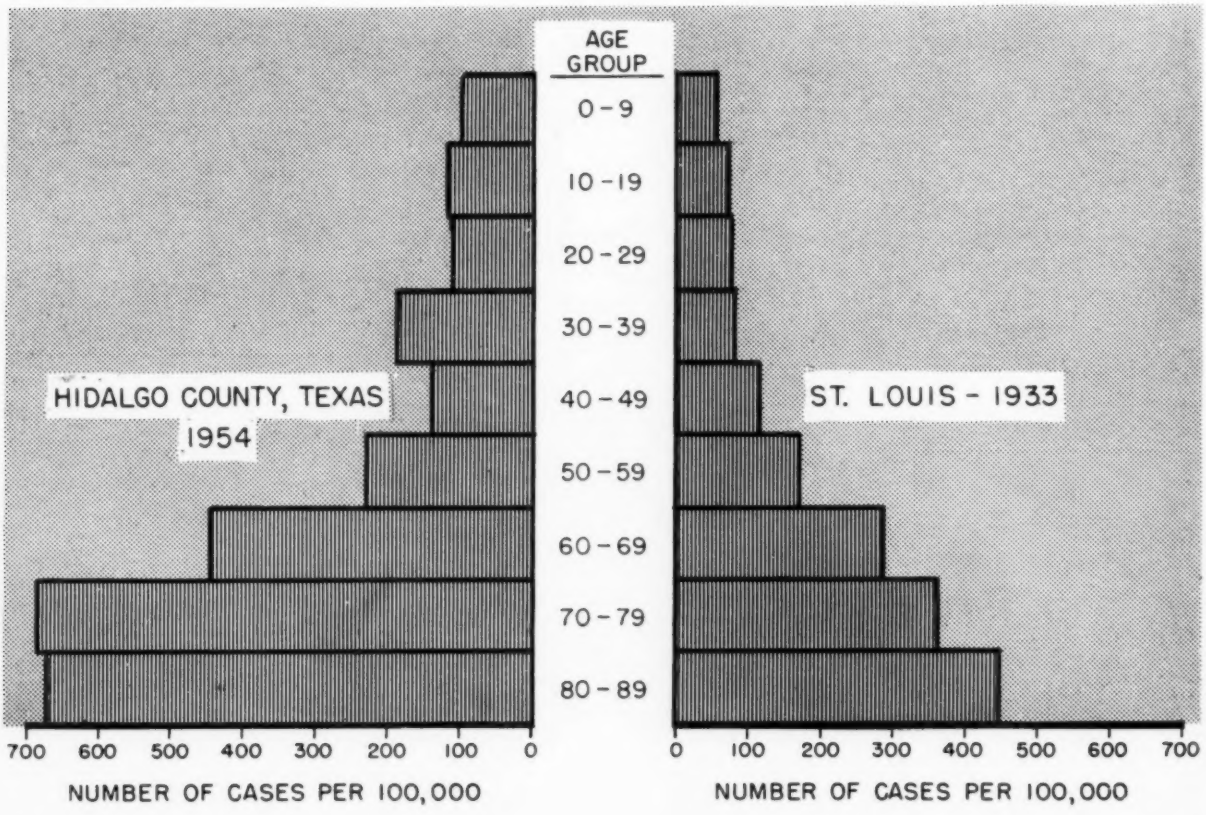
## Discussion

Based on the epidemiological picture and the laboratory findings, the epidemic appeared to be St. Louis encephalitis.

The disease was first encountered in epidemic form in Paris, Ill., in 1932. At that time it was regarded as Von Economo's disease (*1*). During the following summer a similar epidemic occurred in and around St. Louis, with smaller foci in Kansas City, St. Joseph, and Columbia, Mo., and to some extent in the States of Illinois and Kentucky. A total of 1,095 cases were reported in the city and county of St. Louis. This epidemic was thoroughly investigated, and the virus of St. Louis encephalitis was isolated by inoculation of infected human brain tissue into monkeys (*2*). In 1937 an epidemic occurred in the St. Louis area, with 518 cases reported (*3*). Since then small outbreaks and sporadic cases have been reported from various areas, particularly in California and Kansas. And subsequent to this study there were important outbreaks in the lower Ohio Valley in 1955 and in the Texas Panhandle and the Louisville, Ky., areas in 1956.

The epidemiological features and the clinical picture of the present outbreak resemble, in many respects, those of the 1933 St. Louis outbreak. The seasonal incidence, with most of the

**Figure 2. Comparison of attack rates by age, Hidalgo County outbreak and St. Louis outbreak of encephalitis.**



cases occurring during the late summer and early fall, and the age distribution, with the majority of the cases occurring in the older age groups, were strikingly similar. The attack rate for Hidalgo County, however, was higher than that in the St. Louis outbreak, with 163.9 per 100,000 as compared with 99 per 100,000. In comparing the age distribution with that of the St. Louis outbreak in 1933 (fig. 2), it is evident that the two curves are almost identical except that the attack rate in Hidalgo County was greater in each age decade than that in the St. Louis outbreak. In both places, however, the rate increased abruptly after the age of 50.

Further, in the St. Louis epidemic the attack rate was higher in those living in the suburbs of the city. In Hidalgo County a higher rate was observed in the urban population. It should be pointed out, however, that the urban areas of Hidalgo County are more similar to the suburban St. Louis County than to the highly metropolitan city of St. Louis. Also, the areas in Hidalgo County do not lend themselves to a sharp rural-urban distinction, since farm animals, pit privies, and other typically rural characteristics, such as irrigation ditches, weed-covered areas, and standing bodies of water, are often encountered within the city limits. The reporting might also have been more accurate within the cities.

A remarkable feature of this outbreak is the low death rate. Only 10 deaths were attributed to encephalitis, which gives a case fatality of less than 2 percent, while in the St. Louis epidemic the rate was approximately 20 percent.

In the St. Louis outbreak the epidemic began in the rural region of St. Louis County and spread toward and into the city; there was no evidence that the disease had a similar spread in Hidalgo County. Multiple cases in families were uncommon, and there was no evidence that spread was by contact. Further, there was no indication that the disease was spread through a common source medium such as water, milk, or other foods.

Mosquitoes are believed to be important vectors in the transmission of St. Louis encephalitis. Five species of mosquitoes, *Culex tarsalis*, *Culex pipiens*, *C. quinquefasciatus*, *Culex stigmatosoma*, and *Aedes dorsalis* have been found infected with the St. Louis virus in nature (*4*). In the laboratory, the virus has been successfully transmitted to animals by *C. quinquefasciatus*, and by 11 other species from 3 genera, *Culex*, *Aedes*, and *Culiseta* (*5*). In view of the fact that *C. quinquefasciatus* was the predominant species collected in shelters and from biting collections, together with the isolation of the St. Louis virus from two of the pools, the evidence to incriminate this mosquito as the most probable vector in the Hidalgo outbreak is certainly strong.

There was no evidence that more than one virus was associated with the present epidemic, although the occurrence of western equine, eastern equine, and St. Louis encephalitis viruses in the Lower Rio Grande Valley had been previously recognized (*6*). On epidemiological grounds alone, the Hidalgo outbreak was St. Louis encephalitis. In the 1952 outbreak of encephalitis in California, as in the previous years, western equine was predominant in June and July, while St. Louis encephalitis reached its peak in September (10–12). In Hidalgo County, no cases were reported in June and very few in July; most of the cases occurred in late August and early September. Approximately one-third of the cases of western equine in California were in patients less than 1 year of age, whereas in Hidalgo County most of the patients were in the older age groups. Eastern equine encephalitis may be readily excluded on the basis of greater severity and marked age selection involving children primarily. Serologic evidence and absence of epizootics lend further support to this epidemiological reasoning.

## Summary

In an epidemiological study of the encephalitis outbreak occurring during the late summer of 1954 in the Lower Rio Grande Valley, records of 373 reported cases were collected. However, it was estimated that somewhat over 1,000 cases had occurred during the epidemic.

The epidemiological features of the present outbreak resemble, in many respects, those of the 1933 St. Louis epidemic, particularly in regard to the seasonal incidence and the age distribution.

There were only 10 deaths, or a case fatality

of less than 2 percent of the estimated number of cases. Autopsies were performed on 3 of the patients who died, and brain tissue specimens were taken from 2. The virus of St. Louis encephalitis was isolated from 1 of these 2.

*Culex quinquefasciatus* was the most prevalent species of mosquitoes observed, and the St. Louis virus was isolated from two pools of these mosquitoes.

On the basis of the epidemiological picture, together with the confirmatory laboratory support, it was concluded that the outbreak was due primarily to the St. Louis virus.

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## Training Public Health Workers in 1956

More than 17,000 persons received training provided by the Bureau of State Services, Public Health Service, in the fiscal year 1956. Of these, more than 8,000 (46 percent) were from State and local health departments. Almost 4,000 (22 percent) were faculty members and students from universities and students from foreign countries. Nearly 1,500 (8 percent) were in health-related work in industry. Length of training ranged from a 1-hour lecture for university students to 9 months at a university for foreign students. Most of the courses, however, were of 1 to 2 weeks' duration.

The number of courses, as well as trainees, has increased steadily in the past 5 to 10 years. During the fiscal year 1956, the Bureau of State Services offered or participated in courses covering 90 different subjects.

Enrollment for the Communicable Disease Center courses in Atlanta rose from 89 in 1947 to more than 1,190 in 1955. In the Center's field courses, attendance increased from 183 in 1947 to more than 4,600 in 1956.

# Clinical and Pathological Features

CALVIN M. KUNIN, M.D., and TOM D. Y. CHIN, M.D.

CLINICAL data on the 1954 outbreak of encephalitis in Texas were obtained from the 373 cases investigated by the epidemiological team, as well as from the series of 20 cases studied more extensively by Kunin and a retrospective study of 10 known fatal cases. Findings from three autopsies also were used.

Isolation of St. Louis encephalitis virus from the brain of a fatal case and from two pools of *Culex quinquefasciatus* mosquitoes, as well as confirmatory serologic evidence, led to the conclusion that Hidalgo County was experiencing an outbreak of St. Louis encephalitis, probably the largest since the St. Louis epidemic of 1933 (*1*).

## Study Methods

Early in the investigation of this epidemic it became obvious that a careful clinical evaluation of the encephalitic syndrome was imperative, but it was necessary to limit the study because of the shortage of qualified investigators. A group of hospitalized patients considered fairly representative of the more seriously ill was selected. In addition, home visits were made for followup of these patients and to investigate those whose illness was less severe.

Selection of the group chosen for intensive study was based on availability of data regarding pre-encephalitic illness, hospital course, temperature curve, and cerebrospinal fluid, and data from hemogram and other studies. To facilitate communication and followup, Anglo-Americans (as differentiated from Latin-Americans) were selected, as far as possible.

The patients were visited during varying phases of their illness, usually during the acute stage and again 5 to 6 weeks later. Each was given a general physical examination, and a detailed neurological examination with special attention paid to mental status. Discussions were held with a number of key physicians in the area, who together had personally seen more than 300 cases. Their clinical impressions were essentially identical.

In the main, data from 373 epidemiological forms were obtained by lay investigators seeking information at offices of busy local physicians. Cases were accepted as encephalitis if they had been diagnosed as such by the physicians, and no attempt was made to subject these diagnoses to critical scrutiny. The data from these forms were reviewed with this in mind.

An acute and a convalescent blood specimen was drawn on each patient and sent to the bureau of laboratories, Texas State Department of Health. Of the 20 individuals who were subjected to particularly careful investigation, there was serologic information on 12. For 11 of these, a fourfold or greater rise in complement fixing antibody titer to St. Louis encephalitis was demonstrated by the Texas laboratory. A few of these were studied at the Virus and Rickettsia Laboratory, Communicable Disease Center, Montgomery, Ala., with essentially identical findings. The virus of St. Louis encephalitis was isolated from the brain of a fatal case.

*Dr. Kunin was formerly with the Communicable Disease Center of the Public Health Service, on assignment to the University of Michigan School of Public Health, Ann Arbor. He is now assistant resident physician at Peter Bent Brigham Hospital, Boston, Mass. Dr. Chin is assistant chief of the Kansas City Field Station, Kans., Communicable Disease Center.*

## Results

The disease in the Lower Rio Grande Valley, colloquially termed "sleeping sickness," was an acute febrile illness characterized by severe headache, fever, and stupor, with signs of meningeal irritation. The course was self-limited and left few aftereffects. The morbidity was high, particularly in older age groups, but no age was spared. There were 10 deaths attributed to encephalitis. The sex distribution showed a slight preponderance of females.

Characteristically, the onset was relatively abrupt, with fever, severe generalized headache, malaise, nausea, and vomiting. Encephalitic symptoms, predominantly disorientation, irritability, and stupor, began during the first or second day of illness and persisted somewhat longer than the fever. In the more severe cases the delirious state lasted for many weeks.

Data on the relative frequency of the acute complaints show that among 342 cases, 94 percent had fever, 84 percent had headache, and 61 percent, stiff neck. Forty-seven percent experienced vomiting, 46 percent nausea, and 46 percent, muscle pain. Muscle weakness, usually of a generalized nature, was reported in 32 percent of the cases and frequently persisted for many weeks. Twenty-five percent complained of sore throat, 16 percent of constipation, and 12 percent of diarrhea. The distribution of complaints was generally the same for all ages.

On examination, the patients appeared acutely ill; nuchal rigidity and positive Kernig and Brudzinski signs were frequently demonstrated. The diagnosis was often confused with anterior poliomyelitis, in which muscle tenderness and increased resistance to passive motion in the back and hamstrings are also frequently observed. The general physical examination did not reveal any abnormalities in other organ systems.

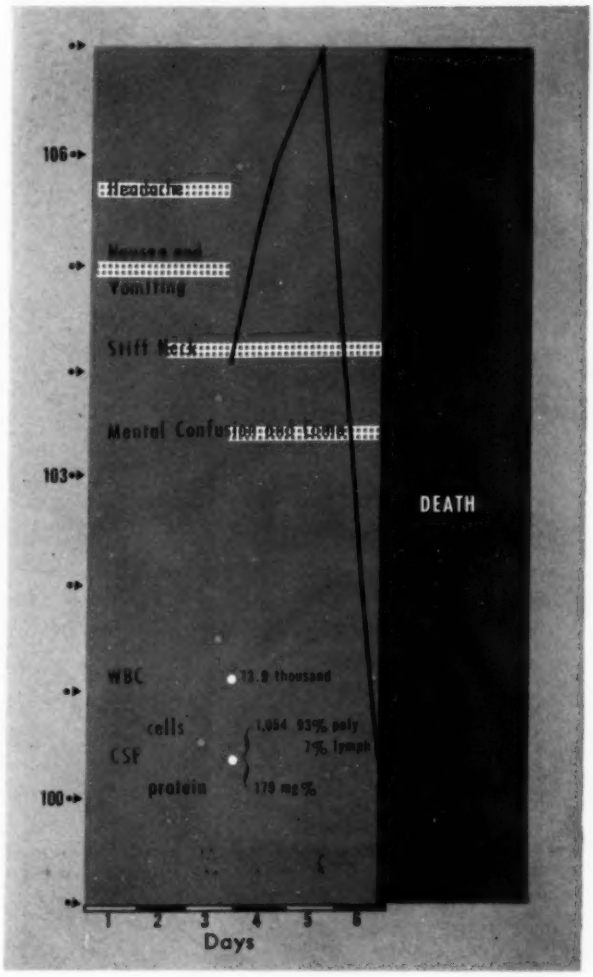
Most profoundly disturbed were the highly integrated functions of the cerebral cortex.

**Summary of clinical data for 10 fatal cases of encephalitis in the Lower Rio Grande Valley, Tex.**

| Patient | Age | Sex | Ethnic group | Days ill | Maximum temperature | Cerebrospinal fluid | | White blood count per cu. mm. | Underlying condition |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Cells | Protein (mg. percent) | | |
| R. A.[1] | 58 | M | Anglo-American | 5½ | 107° F. | [2] 1,054 | 179 | 13,950 | Hypertension, arteriosclerosis, hepatic cirrhosis. |
| A. H. | 68 | F | do | 9 | 105° F. | [2] 47 | 144 | 10,600 | Asthma. |
| C. H. | 68 | F | do | 18 | 101.6° F. | [2] 647 | 99 | 19,600 | Asthma, bronchitis. Head injury in auto accident 1 year prior to death. |
| A. M. | 60 | F | Latin-American | 7 | 105° F. | [3] 183 | 76 | 8,500 | 2-week diarrhea. |
| R. M. | 89 | F | Anglo-American | 4 | 104° F. | ---- | ---- | 10,000 | Arthritis (senile). |
| M. H. | 83 | F | do | 8 | 102° F. | ---- | ---- | 6,100 | Hypertension, azotemia, arteriosclerosis, on digitalis, terminal pneumonia. |
| P. C. | 43 | F | Latin-American | 17 | 102.5° F. | [2] 37 | [4] | 4,800 | None. |
| L. L. | 80 | F | Anglo-American | 7 | 103.4° F. | ---- | ---- | 10,800 | Congestive heart failure, arteriosclerotic heart disease, bronchopneumonia. |
| M. P. | 9 | M | do | 4 | 103° F. | [5] 150 | 50 | 9,000 | None. |
| E. E. | 9 mos. | F | Latin-American | 3 | Febrile | [2] 52 | ---- | 18,600 | Mother had pulmonary TB and in contact with child during and prior to illness. |

[1] St. Louis virus isolated.
[2] Mostly polymorphonuclear.
[3] Equal number of polymorphonuclear leukocytes and lymphocytes.
[4] Pandy test negative.
[5] Mostly lymphocytes.

**Figure 1. The course of a fatal case from which St. Louis encephalitis virus was isolated.**




This took the form of disorientation, stupor, and coma. At the onset of the encephalitis course, many of the more severely ill patients were agitated and difficult to manage. Within a few days the effect became bland, faces expressionless but not rigid. A number of these patients demonstrated poor general knowledge, defects in recall of recent events, and poor orientation to time, place, and person. There was no evidence of specific cerebellar damage, no muscular rigidity or nystagmus. The gait was unsteady, but the Romberg test was negative. There were no reports of oculogyric crises, Parkinsonism, or athetosis. Paralysis was rarely seen and no sensory changes could be detected. Frequently during the acute illness and persisting for at least a number of weeks during convalescence, a fine intention tremor of both hands could be demonstrated. There was no wasting nor were there any trophic changes.

The febrile course usually persisted for 3 to 7 days and generally cleared by lysis, with the maximum temperature usually reached by the second to third day. Temperature data on 260 patients indicate that more than half had a maximum of 103° F., while about 10 percent had a temperature over 105° F. A few of the more seriously ill patients, usually in the older age group, had a more prolonged illness, with a low-grade fever persisting 2 to 3 weeks. The younger patients generally had higher temperatures with shorter courses.

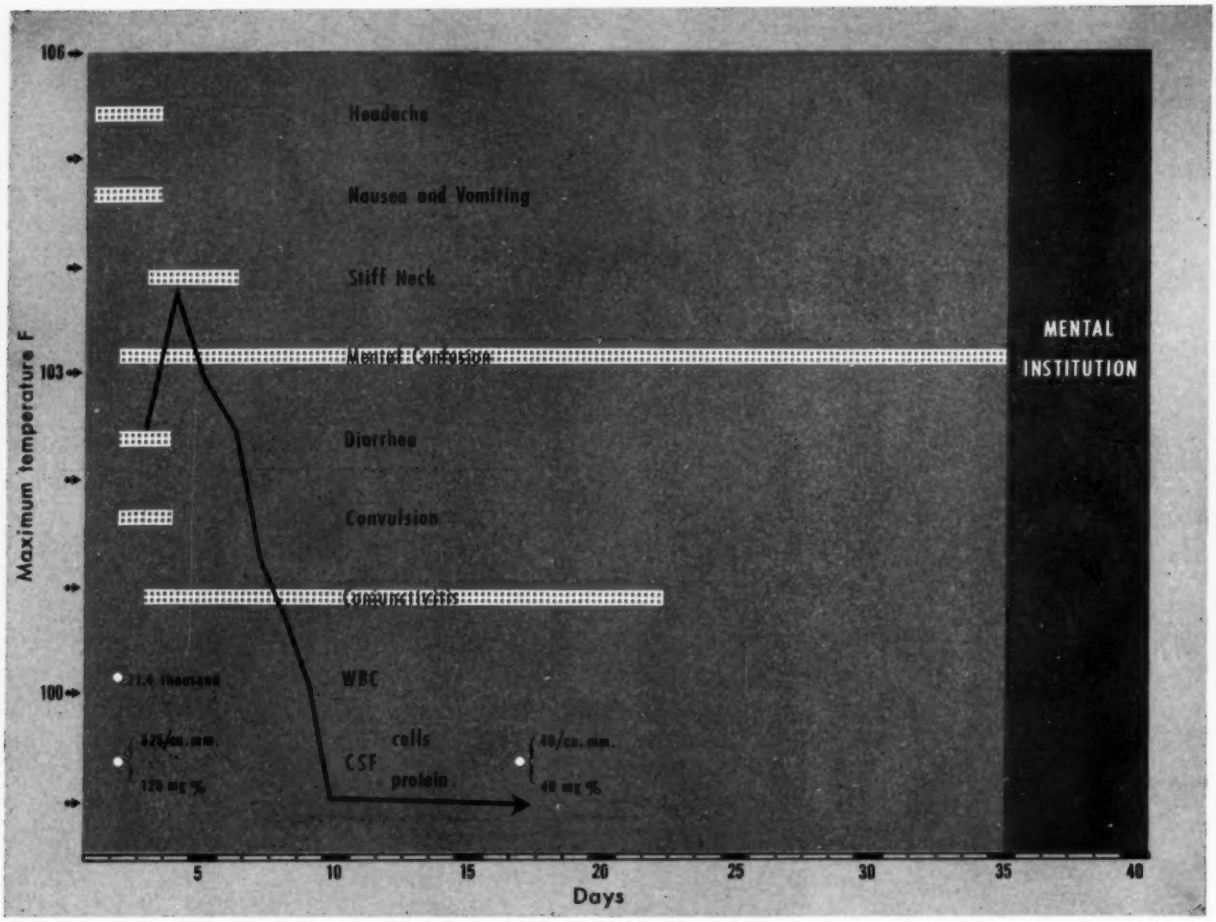
Convulsions occurred in the more severely ill patients, in most cases after the fever had begun to lyse. They were described as generalized and were seen in all age groups. A few infants demonstrated grand mal convulsions at the onset of illness when maximally febrile. In adults and older children with convulsions, the disease was more prolonged, the neurological damage was more pronounced, and the residual effects were more persistent. One patient (B. S.) apparently suffered irreversible brain damage and was placed in a mental institution. The others had surprisingly little aftereffects.

In most cases the course was fairly benign. Many had only a brief febrile illness with headache which lasted a few days. Upon recovery, the patient suffered no apparent aftereffects. A smaller number of patients developed a more progressive illness as described above, and an even smaller group developed full-blown encephalitis. Finally, there were the few critically ill patients with profound deliriums. Among those of this group who survived, the paucity of residual effects was remarkable. Observing the acute phase of the illness, one could not predict the outcome in terms of aftereffects to be seen 5 to 6 weeks later.

Ten persons died (see table), 8 females and 2 males. Eight had passed 40 years of age; 6 were 60 years of age or older. Most of the older patients also had degenerative diseases such as hypertension or arteriosclerosis, and two were asthmatic. Only 2 were ill longer than 2 weeks.

The course of the acute phase of illness is graphically portrayed for 5 hospitalized indi-

**Figure 2. The course of a severe case with aftereffects.**



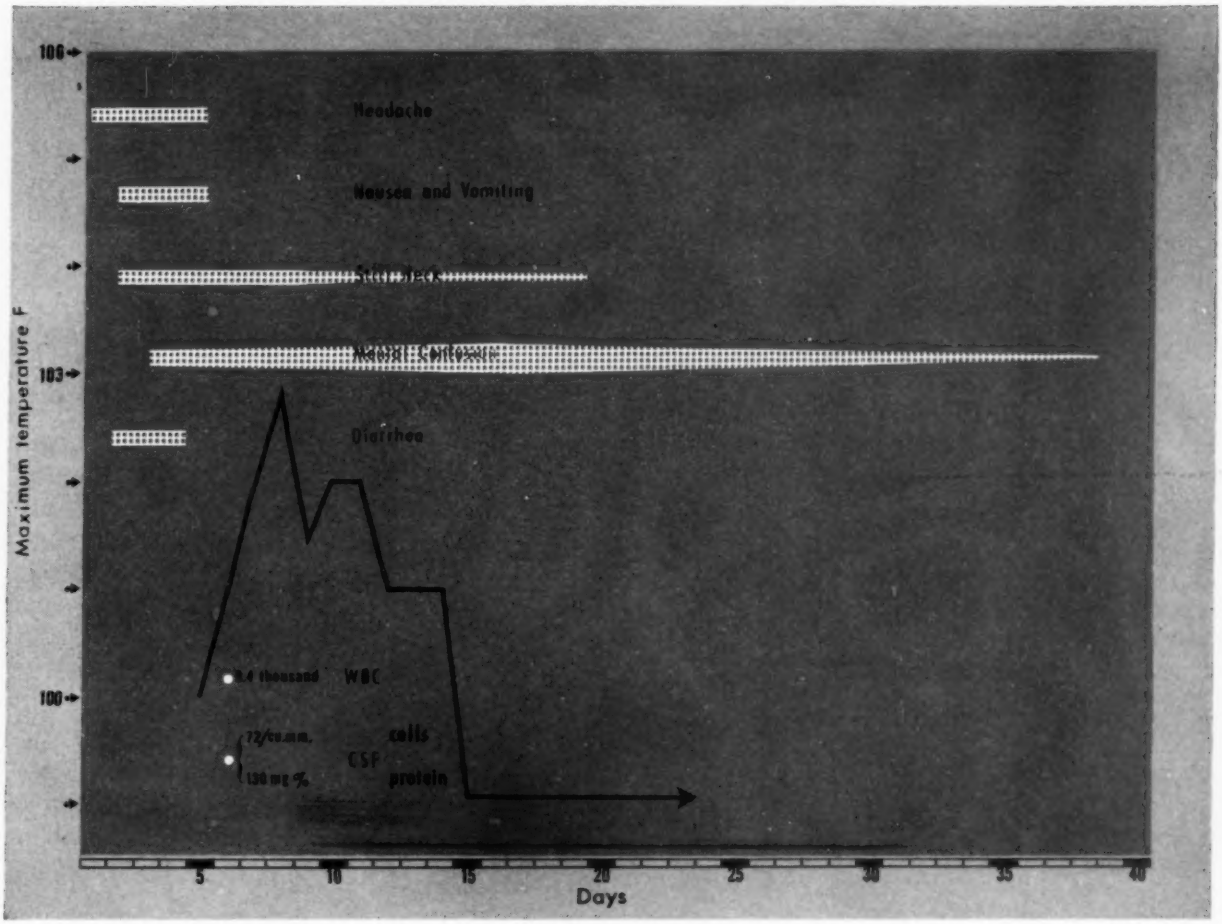

viduals. Case R. A. (fig. 1) was the patient from whom St. Louis virus was isolated. The course was quite fulminant and lasted but 5½ days. Case B. S. (fig. 2) was the most severely ill of those patients who survived. The period of mental confusion was far longer than that seen in other patients. Figures 3, 4, and 5 illustrate the more usual clinical course of severely ill patients who, after recovery from the febrile, confused, early phase of the illness, appeared to be quite well except for weakness and tremors. Case C. A. (fig. 5) was the only individual seen by the investigators who had a paralytic component, a transient left facial weakness.

### *Clinical Laboratory Findings*

For most of the patients, laboratory studies consisted of a single test performed in the acute phase of the illness. The white blood count was reported in 118 cases. Leukocytosis was moderate, with almost half of the cases exhibiting counts greater than 10,000 cells per cu. mm., but only 7 (about 6 percent) showing counts over 20,000 cells per cu. mm. Two patients had less than 4,000 cells per cu. mm. In general, the ranges were evenly divided among all age groups, the younger patients tending to have a greater leukocytosis. There was no breakdown for differential counts.

Spinal fluid data were reported in 110 cases. Eighty percent demonstrated a pleocytosis greater than 10 cells per cu. mm. in the cerebrospinal fluid (CSF). The majority of patients had counts in the range of 50–250 cells per cu. mm. Only 3, or slightly more than 2 percent, had a cell count greater than 500 per cu. mm. In general, the younger patients had a greater pleocytosis than those in the older age groups. There was no direct correlation between severity of illness and CSF cell count. Differential

**Figure 3. The course of a severe case with good recovery.**




counts reported in 40 specimens performed during the acute illness demonstrated that polymorphonuclear cells predominated. In a few individuals tapped later in the course, the cells generally were mononuclear.

The CSF protein as determined in 92 patients was elevated above 40 mg. percent in about 80 percent of cases. In a few, values over 200 mg. percent were recorded.

### *Neuropathological Findings*

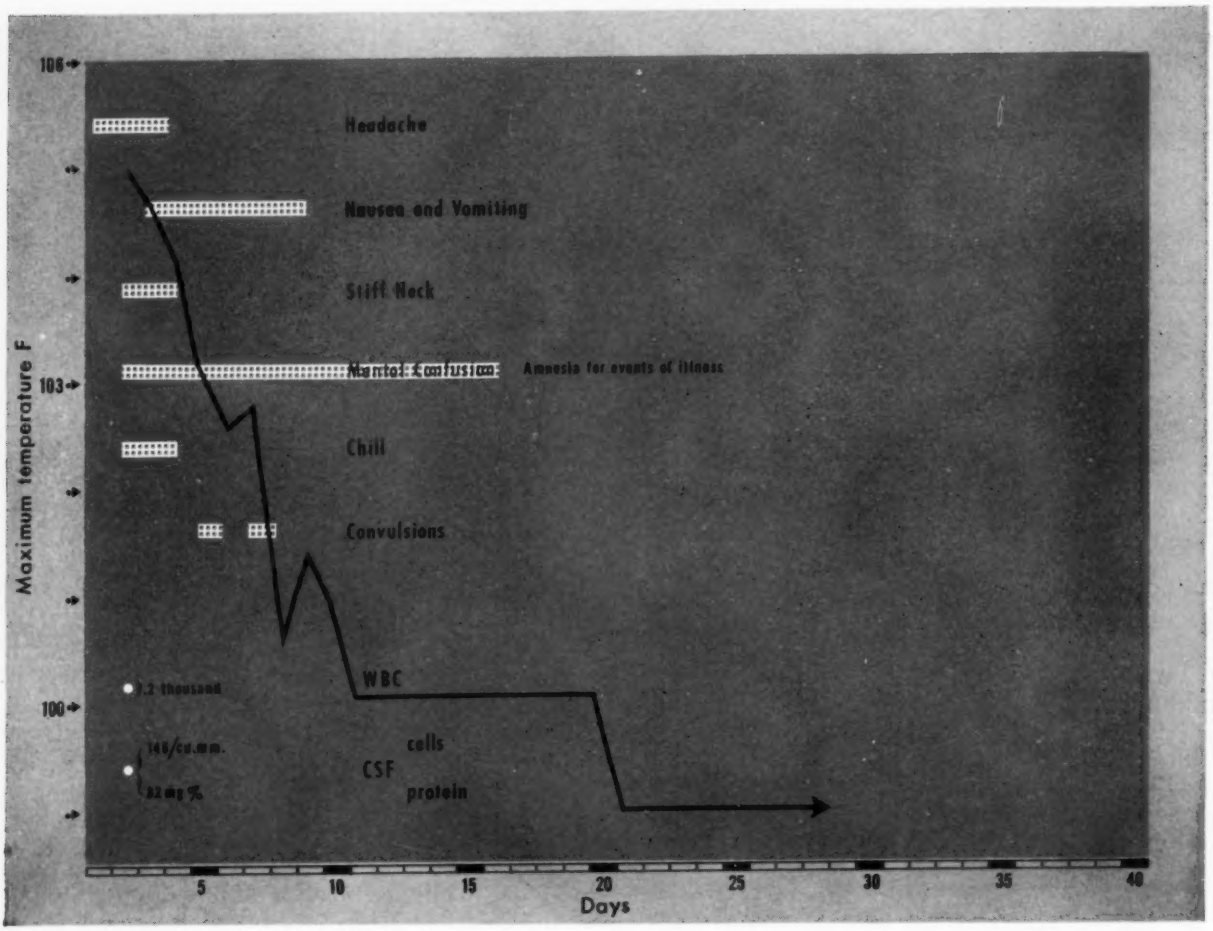
Pathological examination was performed on the brain tissue of 3 fatal cases, including 1 from which the virus was isolated.

Gross findings were reported normal in one case autopsied by a local physician. In the others the brain tissue was diffusely edematous and hyperemic. The meninges were thickened and the meningeal vessels were congested. On sectioning, petechial hemorrhages and discoloration were found in the gray matter. The tissue was soft and pliable.

On microscopic examination, the leptomeninges were thickened and the blood vessels congested and dilated. The histological changes in the brain consisted of perivascular infiltration, proliferation of microglial cells, and neuronal degeneration. These lesions were observed in all parts of the brain, in the white matter as well as in the gray matter, with the basal structures most intensely affected. Extravasation of blood into perivascular spaces and petechial hemorrhages into the brain substance were also encountered.

Microglial proliferations were frequently seen, although they were not so common as perivascular infiltrations. These lesions appeared as focal collections of inflammatory cells, the bulk of which consisted primarily of proliferated microglial cells. Under low-power

**Figure 4. A severe case in a Mexican farm laborer (bracero) with good recovery, exhibiting amnesia for the events of his illness.**




magnification, these foci appeared as glial nodules. In the areas with more intense cellular infiltration, neuronophagia could be noted. Several states of degeneration were observed in nerve cells, varying from mild cytoplasmic changes to complete cellular destruction.

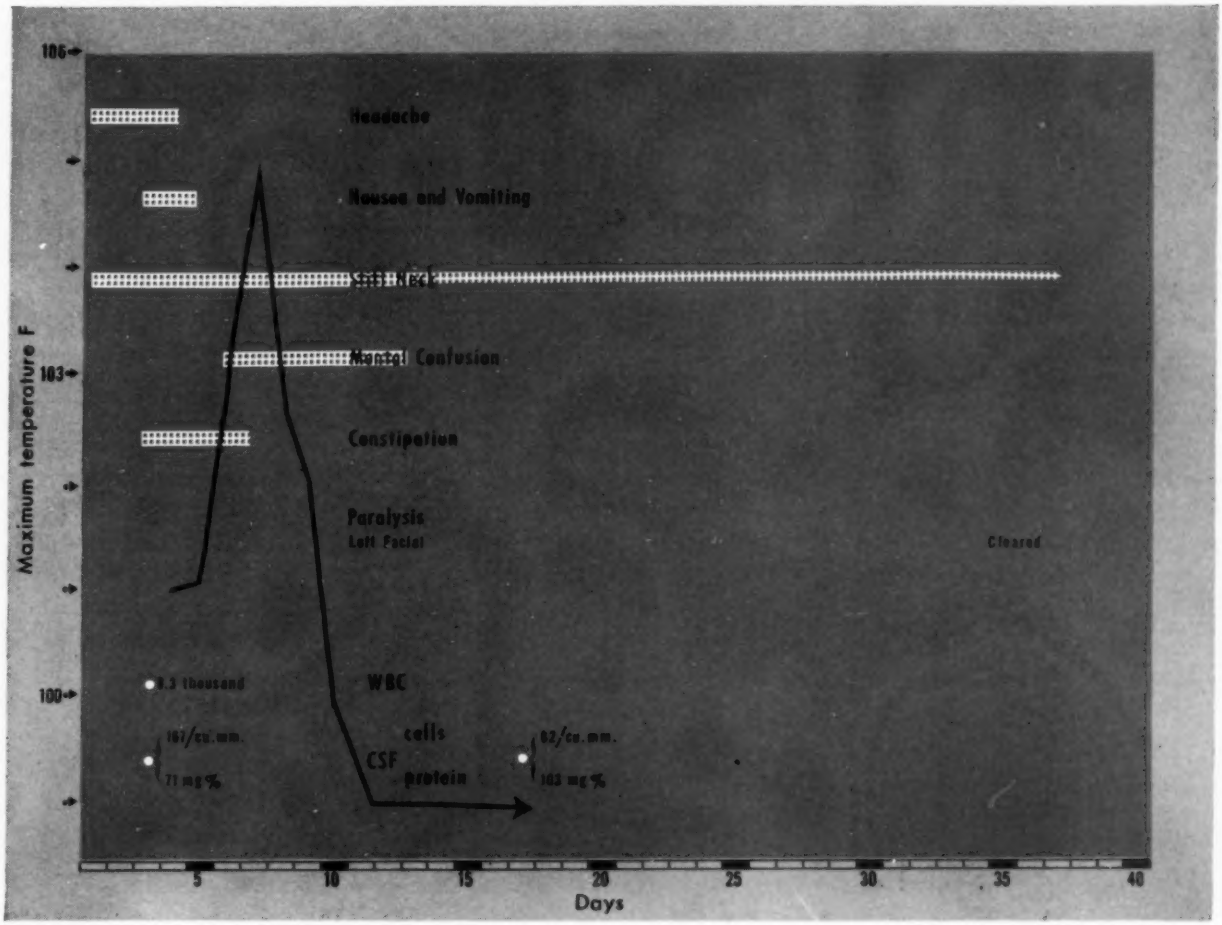
## Discussion

On a clinical basis, this epidemic may be described as a generally mild, occasionally severe encephalitis with a high morbidity, a low mortality, and an approximately equal sex ratio. Remarkable features are acute onset with the development of high fever, usually clearing by lysis, severe headache, and striking recoveries in severely ill patients after prolonged coma and convulsions. This study was confined to a 5- to 6-week followup after onset. Personality changes during the acute illness were profound in a number of individuals but the prognosis for most should be good (*2*).

Although in the fatal cases lesions were distributed throughout the brain and were particularly noticeable in the basal structures, clinically, the higher integrative functions of the central nervous system were most profoundly disturbed. Paralysis, ocular palsies, and discrete localization of neurological signs were infrequent. The dulling of effect and intellectual functions, generalized weakness, and bilateral tremor of the hands were pronounced features in the convalescent patient.

The laboratory findings of a moderate pleocytosis and an elevated spinal fluid protein were typical of aseptic meningitis, and pathologically the lesions were consistent with those of the arthropod-borne encephalitides (*3*, *4*).

**Figure 5. The course of a moderately severe case exhibiting transient left facial weakness.**




The findings were not diagnostic of St. Louis encephalitis itself and could not be used as criteria to differentiate it from other encephalitides.

Most of the patients who died had some form of chronic disease which probably contributed to death, and most of them were over 50 years of age. Clinically, this epidemic displayed many of the features of St. Louis encephalitis, and this diagnosis is entirely compatible with the findings.

## Summary

The description of the clinical and pathological features of the 1954 outbreak of encephalitis in the Hidalgo area of Texas is based on 20 cases studied by Kunin, 373 cases reported on clinical-epidemiological forms, and results of 3 autopsies. It is concluded that the clinical and pathological features of this epidemic are similar to those previously described for St. Louis encephalitis.

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# Laboratory Aspects

THELMA D. SULLIVAN, M.S., J. V. IRONS, Sc.D., and M. MICHAEL SIGEL, Ph.D.

SPECIMENS from persons with encephalitis and those taken at autopsy were tested extensively in laboratory studies of the 1954 outbreak in Texas. Pooled mosquitoes from the affected area, the Lower Rio Grande Valley, were also examined for the presence of St. Louis encephalitis virus.

## Methods and Materials

White Swiss mice have proved useful (*1*) for the recovery and identification of the encephalitis viruses and for the performance of serum virus neutralization tests (*2, 3*). Mouse brain antigens also have been useful in the performance of the complement fixation tests (*4–6*) as a diagnostic aid.

Ten percent brain suspension from two fatal cases was employed for attempted recovery of an agent by the inoculation of mice, chick embryos, baby chicks, and HeLa cell cultures. An agent also was sought in a few selected stools, throat swabs, and serums and spinal fluids by the inoculation of tissue cultures and mice.

For the determination of antibody content of selected serums, the virus neutralization test was employed. The screening test was based on 10 and 100 $LD_{50}$ doses of virus mixed with equal quantities of uninactivated undiluted serum; subsequent tests made use of larger doses of virus. Three-week-old white Swiss mice were inoculated intracerebrally and were observed for 2 weeks.

The complement fixation test was performed at the Texas State Department of Health laboratory with 0.25 ml. of twofold serum dilutions, 0.25 ml. of antigen at the optimal dilution, 0.5 ml. of complement (2 exact units), and 0.5 ml. of sensitized sheep cells containing amboceptor in optimal dilutions. At the Virus and Rickettsia Laboratory of the Communicable Disease Center in Montgomery, Ala., the corresponding amounts were 0.1 ml. of serum, 0.1 ml. of antigen, and 0.2 ml. of complement (1½ to 2 units). The primary incubation was done overnight in the cold room. A full set of controls and a supplementary amboceptor titration were included. The second incubation was carried out for 1 hour at 37° C. (½ hour at the CDC laboratory).

The degree of hemolysis was recorded after 2 hours' refrigeration. (In the CDC laboratory the test was read directly without additional refrigeration.) Titers were based on the last tube showing a 3+ or 4+ fixation. Lederle antigens were employed, except that in addition to the Lederle St. Louis antigen, a second St. Louis antigen and control were prepared from mouse brains at the Texas laboratory by the method of España and Hammon (*7*), and the influenza and mumps antigens were made at the CDC laboratory in Montgomery. All serum samples from the same patient were tested simultaneously when they were available. Most of the specimens were split for tests in both laboratories.

Paired serum specimens from cases showing poor or no serologic response to St. Louis antigen were also screened with western equine

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encephalitis (WEE), eastern equine encephalitis (EEE), and lymphocytic choriomeningitis (LCM) antigens, and some were screened with mumps, influenza, and other antigens.

More than 2,000 adult mosquito specimens were collected by the entomological team and sent to the laboratory for virus isolation studies. The majority were received in a frozen state, but a few were sent alive to the State laboratory.

In the laboratory, the mosquitoes were pooled for animal inoculation, separation being based on species and place of collection. A suspension of the macerated mosquitoes was spun in a refrigerated centrifuge, and antibiotics were added to the supernatant. Infant mice were inoculated with subpool material by the subdural and intraperitoneal routes, and a guinea pig received an overall pool in a like manner. Two further brain passages were made in mice before a test was considered negative. The guinea pig was bled a month later for serologic studies.

### Results

Several isolation attempts were made with brain tissues from R.A. and C.H., two patients

**Table 1. Complement fixation antibody pattern of 110 serum samples**

| Baseline serum taken (days) | Results | Followup serum taken (days) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 0–7 | 8–14 | 15–21 | 22–36 | 37–56 | 57–85 | Later |
| 0–7 | Negative | 3 | 2 | 4 | 2 | 1 | | |
| | <4>4 | | | 2 | | 2 | | |
| | No change | | 4 | 1 | 3 | 2 | | |
| | Rise | | 4 | 5 | 11 | 3 | | |
| | Decline | | | | | | | |
| | **Total** | **3** | **10** | **12** | **16** | **8** | | |
| 8–14 | Negative | | | 1 | 1 | 2 | | |
| | No change | | | | 8 | 6 | | |
| | Rise | | | 1 | 6 | 2 | 2 | |
| | Decline | | | | | | | |
| | **Total** | | | **2** | **15** | **10** | **2** | |
| 15–21 | Negative | | | | | 3 | | |
| | No change | | | | | 2 | 3 | |
| | Rise | | | | | | 2 | |
| | Decline | | | | | | | |
| | **Total** | | | | | **5** | **5** | |
| 22–36 | Negative | | | | | 1 | | |
| | No change | | | | | 2 | 5 | 2 |
| | Rise | | | | | 2 | 1 | |
| | Decline | | | | | 1 | | 1 |
| | **Total** | | | | | **6** | **6** | **3** |
| 37–56 | Negative | | | | | | 1 | |
| | No change | | | | | | 1 | |
| | Rise | | | | | | | |
| | Decline | | | | | | | 3 |
| | **Total** | | | | | | **2** | **3** |
| 57–85 | Negative | | | | | | | |
| | No change | | | | | | | |
| | Rise | | | | | | | |
| | Decline | | | | | | | 2 |
| | **Total** | | | | | | | **2** |

NOTE: No change means antibodies present, but without significant fourfold rise.

**Table 2. Range of complement fixation titers for St. Louis encephalitis, by week after onset of illness**

| Number of weeks after onset of illness | Total number of serums tested | Range of complement fixation titers | | |
|---|---|---|---|---|
| | | Lowest | Highest | Mean |
| 1 | 56 | <1:4 | 1:16 | <1:4 |
| 2 | 55 | <1:4 | 1:128 | 1:8 |
| 3 | 34 | <1:4 | 1:256 | 1:16 |
| 4–5 | 54 | <1:4 | 1:128 | 1:16 |
| 6–8 | 35 | <1:4 | 1:128 | 1:16 |
| 9–12 | 14 | <1:4 | 1:64 | 1:16 |
| 20–22 | 8 | <1:4 | 1:16 | <1:4 |

who died. An agent was recovered with brain tissues from R.A. by the intracerebral inoculation of 2-week-old and 17-day-old mice. Two-week-old mice showed evidence of infection by the 7th day and on passage by the 6th day. When one 17-day-old mouse was found dead on the 6th day, two mice which were not ill were sacrificed on the 7th day for "blind passage" in young adult mice. These mice showed evidence of infection by the 5th or 6th day. Three-week-old mice were much less satisfactory for primary isolation. The R.A. agent was not lethal for chick embryos and produced no obvious illness in guinea pigs. It was identified as SLE virus by means of a neutralization test.

Stools from 17 cases, 10 early acute phase serum samples, 7 throat swabs, and 6 spinal fluids failed to yield an agent by inoculation and by attempted "blind passage" in infant or young adult mice. Negative results were also obtained from inoculations of baby chicks and strain HeLa tissue cultures.

A total of 29 pools of mosquitoes, comprised of 1,613 specimens representing 11 species, were tested for presence of virus, with the result that two strains of St. Louis virus were isolated from *Culex quinquefasciatus* collected at Edinburg in September 1954.

The serologic results obtained on the divided specimens in the two laboratories were in essential agreement. The results used for the tables, with the exception of the serum-virus neutralization tests, were obtained primarily at the Texas bureau of laboratories.

In complement fixation tests, fourfold or greater titer rises were demonstrated in 38 cases, representing 43.7 percent of the 87 cases tested. Paired serum samples from 17 cases failed to show complement fixation titers, at least at the 1:4 (3+) level, and 32 cases showed no significant change in titer. Tests on serums collected after the 13th week were excluded. The extent of change in titer of serums collected from 87 patients is shown in table 1. Only 1 of 29 paired serum samples collected up to the 9th week showed a decreasing titer, but 6 of 8 pairs of samples taken 20 to 22 weeks after onset of illness showed greatly decreased or totally absent titers. Mean titers by week after onset of illness are shown in table 2. The titers ranged from less than 1:4 (3+) through 1:256 (4+).

Seventy percent of the serums collected from 50 persons, who presumably were exposed but not ill, had titers from 1:4 through 1:128 (table 3). These specimens were collected at the close of the epidemic, mainly from other members of families in which proved cases of SLE had occurred.

Serum-virus neutralization tests were performed on paired serums from 7 cases and single serums from several cases. The relation of the neutralization indexes to the complement fixation titers on paired serums is shown in table 4.

Paired serum samples from 12 clinically diagnosed cases showed no antibodies or failed to

**Table 3. Results of complement fixation tests for St. Louis encephalitis on persons not ill during outbreak of encephalitis in Lower Rio Grande Valley**

| Number of persons tested | Number with complement fixing titer of— | | | | | | | Total number with titer of 1:4 or greater | Percentage of total with titer of 1:4 or greater |
|---|---|---|---|---|---|---|---|---|---|
| | <4 | 4 | 8 | 16 | 32 | 64 | 128 | | |
| 50 | 15 | 3 | 10 | 9 | 7 | 4 | 2 | 35 | 70.0 |

**Table 4. Comparative data on complement fixation titers and neutralization indexes on cases in outbreak of St. Louis encephalitis in the Lower Rio Grande Valley**

| Case No. | Date of onset of illness | Date specimen taken | Complement fixation titer | | | | Neutralization index |
|---|---|---|---|---|---|---|---|
| | | | 8 | 16 | 32 | 64 | |
| 8 | 9–4 | 9–4 | | | | | 0 |
| | | 9–20 | | | | | 0 |
| 13 | 8–12 | 9–17 | 4 | 4 | | | 21 |
| | | 10–20 | 4 | 3 | | | 32 |
| 14 | 8–25 | 8–27 | | | | | 0 |
| | | 9–17 | 4 | 4 | 4 | 4 | 14 |
| 16 | 8–31 | 9–13 | | | | | 0 |
| | | 9–20 | | | | | 0 |
| 19 | 8–19 | 8–27 | | | | | 0 |
| | | 9–16 | 4 | 4 | 4 | | 68 |
| 27 | 9–12 | 9–23 | | | | | 0 |
| | | 10–23 | | | | | 0 |
| 29 | 9–4 | 9–4 | | | | | 14 |
| | | 10–22 | 2 | | | | 68 |
| 51 | 9–2 | 9–14 | 4 | 4 | | | 140 |
| | | 10–22 | 4 | 4 | 3 | | 140 |
| 67 | 8–17 | 9–20 | 3 | | | | 68 |
| | | 10–23 | 3 | | | | 140 |
| 82 | 8–30 | 9–23 | 4 | 3 | | | 21 |
| | | 10–23 | 4 | 4 | 4 | 4 | 210 |

show a significant increase in titer in complement fixation tests in which SLE, WEE, EEE, and LCM antigens were utilized. Single serums from several cases also were negative in the WEE test. Paired samples of serum from 7 cases were negative in hemagglutination-inhibition tests for influenza A, A-prime, and B. Four paired serum samples were negative for mumps, typhus, Q fever, and diseases of the lymphogranuloma venereum and psittacosis group. Paired samples from 2 cases and a single serum from each of 6 cases were negative in the complement fixation test with Venezuelan equine antigen supplied by Dr. E. H. Lennette of the California State Health Department. Similarly, 4 serums were negative for Japanese B encephalitis and herpes. Agglutination tests with the "febrile" bacterial antigens were essentially negative.

## Discussion

In our experience positive results are a rarity in serums submitted from sporadic cases of encephalitis. This had been the experience of Casals (*8*) also. In fact, the validity of the CF test in SLE has occasionally been questioned. By contrast, the findings from the current study indicate that CF antibodies to the causative agent are readily demonstrable in the great majority of patients in an epidemic. Thus, 70 of 87 patients (80.5 percent) were found to possess antibodies to the SLE virus, and 38 of these 87 (43.7 percent) showed a significant rise in titer.

These results confirm the observation of Howitt (*4*) and supply more evidence for the value of the CF test in the diagnosis of SLE. Demonstrations of a significant rise in titer required proper spacing of specimens. When the first specimen was taken during the first week of illness and the second specimen was collected during the second and third weeks of illness, 9 of 22 individuals showed a rise in titer. The rise was encountered most frequently between 22 and 36 days (11 of 16). The comparison of results obtained when the baseline serum was taken during the second week of illness and the followup serum samples 3, 4, 5, or more weeks after onset revealed a fourfold or greater rise in 11 of 29 patients. Using as baseline the samples of serum taken during the third week, there were only 2 rises among serum samples of 10 patients.

In 10 of 46 patients, antibodies present during the first week exhibited no significant rise during subsequent weeks. This suggests two possibilities: Either the CF antibodies to SLE develop quite early in some patients or the in-

formation about the date of onset was inaccurate. Howitt (*4*) recorded positive reactions in 12 of 26 serums taken prior to the end of the first week.

The CF antibodies to the SLE virus were found to decline fairly rapidly. Thus, 6 of 8 patients showed a fourfold or greater decrease in titer in serums obtained beyond the 85th day after onset. Unchanged titers were still present, however, in two individuals. The relatively quick antibody decline was also noted by Howitt (*4*).

Among the serum samples collected from persons who presumably were exposed but who were not ill, 70 percent contained CF antibodies. This finding provides evidence that the virus may cause many inapparent infections.

The success in obtaining useful serologic information was primarily due to the availability of multiple specimens. This study reemphasizes the need for comparative testing of two (and sometimes more) specimens from a patient. Although in this study the infection with SLE virus was associated with a pattern consisting of antibody rise after the first week of illness (most rises were detected between 22 and 36 days) and antibody decline after 3 months, the variability in time of antibody appearance, in the rate of antibody rise, and in the rate of antibody fall makes it difficult and often impossible to interpret validly the results of a single serum.

Laboratories that may be called upon to perform similar tests in the future are cautioned about the reliance on standardization of antigens prepared outside their laboratories. Failure to assay each antigen for its CF activity using several positive serums and the investigator's technique which will later be used in the test may lead to weak and inconclusive reactions.

The neutralization test also yielded positive results. However, the number of serum samples tested was too small to warrant specific conclusions.


## Summary

In studies of human cases, virologic and serologic tests proved that the epidemic of encephalitis in the Lower Rio Grande Valley of Texas in 1954 was caused by the St. Louis type of virus. Isolation of St. Louis encephalitis virus from two pools of *Culex quinquefasciatus* taken in the areas supported the diagnosis.

The complement fixation test was found to be of great value.

Detection of significant rise in titer required proper spacing of specimens.

It was found that inapparent infections had occurred with great frequency.


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# Vector Evaluation and Control

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THE likelihood that the encephalitis reported in the 1954 Texas outbreak might be borne by mosquitoes or other arthropod vectors prompted an entomological investigation which commenced in late August. After the appraisal, a vector control program was initiated.

At least three distinct viruses have been shown to be responsible for periodic outbreaks of infectious encephalitis in the United States. Two of these, eastern equine encephalitis and western equine encephalitis, also occur in epizootic form in horses. The third, St. Louis encephalitis, does not produce clinically recognizable symptoms in horses. Both man and horses are generally believed to be dead ends in the infection chain in nature. The viremic blood levels are seldom high enough in either to infect even the most efficient vectors. Studies on these viruses have demonstrated that birds are the most common vertebrate hosts and mosquitoes the most significant vectors.

## Background

The Lower Rio Grande Valley of Texas is a semitropical area with a climate and topography especially propitious for the production of mosquitoes. Several species of the local mosquito fauna are not found in other sections of the United States. The average annual rainfall is about 24 inches and natural drainage is poor. The elevation is only 40 to 200 feet above sea level, and prolific vegetation clogs the drainage ditches. The mean average temperature is 72° F., and killing frosts are seldom experienced.

Conditions favorable for mosquito production existed in Hidalgo County, located in this area, in the spring of 1954. During the period April 8–14 an average of 10 inches of rain fell over an extensive irrigated section. The nature of the terrain permitted large residual bodies of water to stand for varying periods of time. A reconnaissance survey of the flooded area revealed that emergency mosquito control measures were needed throughout the urban and rural areas of a section bounded by the cities of Edinburg on the northwest, Pharr on the southwest, Donna on the southeast, and Elsa on the northeast (see map, p. 511). Spot mosquito control was also necessary in residual floodwater areas as far west as Mission and as far east as Mercedes.

On April 16 the Governor of Texas declared a state of emergency in Hidalgo County. Following a request for assistance from the county health officer, the Texas State Department of Health and the Public Health Service combined forces to provide technical assistance, labor, equipment, and insecticides for an emergency mosquito control program. During the period April 22–May 8 a total of about 1,784 acres of water was larvicided, 13,942 acres space-sprayed (adulticided), and 304 premises residual-sprayed (*1*). Since numerous artificial containers in and adjacent to private premises were filled with water and presented a problem beyond the scope of an emergency control crew, the press and radio were utilized to

*Mr. Beadle and Mr. Hayes are both senior sanitarians with the Communicable Disease Center, Public Health Service. Mr. Von Zuben and Dr. Eads are with the Texas State Department of Health, Austin, Tex. Mr. Menzies served with the same department before his death.*

instruct the public in simple mosquito control measures. Heavy earth-moving equipment was brought in by the Texas Highway Department for constructing channels to drain the larger bodies of standing water. An extensive inspection survey on May 7 indicated that the adult mosquito population had been reduced to negligible levels.

### Vector Evaluation

Representative samples of mosquito larvae were collected during the week of August 30 to September 4 from such habitats as roadside ditches, rain pools, seepages, dairy drains, sewage plants, reservoirs, and artificial containers on premises. Four species were represented in these collections: *Psorophora confinnis*, *Culex quinquefasciatus*, *Culex coronator*, and *Aedes vexans*. *P. confinnis* was predominant in temporary water habitats produced by rainfall during the week prior to the investigation. *C. quinquefasciatus*, the most prevalent, was found breeding in artificial containers, especially those used for watering domestic animals, and in semipermanent ground pools and drainage ditches, particularly near sewage disposal plants.

Collecting adult mosquitoes was emphasized for virus recovery tests. Specimens were gathered by the use of 3 New Jersey-type light traps, by 3 inspectors hand-collecting from shelters, and by 1 inspector assigned to biting collections. Most collecting was concentrated in areas where encephalitis cases had been reported. The majority of specimens collected for virus recovery tests were lightly anesthetized with chloroform, identified, sealed in Wassermann tubes, and sent to the laboratories in a frozen state. The remainder were sent alive to the State laboratory.

A diligent search for adult mosquitoes resulted in only about 2,000 specimens during 2 weeks of collecting. This was attributed to prevailing dry and hot weather immediately preceding the outbreak and to the intensive mosquito control operations following the April flood.

The scarcity of mosquitoes in the area is revealed by the fact that only 530 female mosquitoes were collected during 19 trap nights (table 1). *P. confinnis* ranked first (61.3 percent), followed by *C. quinquefasciatus* (13.7 percent) and *Aedes sollicitans* (13.0 percent).

Hand collections in animal shelters, garages, and outbuildings indicated that *C. quinquefasciatus* was by far the most common species of adult mosquito in both urban and rural areas (table 2). Approximately 94 percent of all specimens collected (1,083) were of this species.

Biting collections of mosquitoes alighting on exposed skin of the human observer were made at night in five residential areas. These collections indicated that *C. quinquefasciatus* was the predominant pest species in the area during the time of the study (table 3). Over 76 percent of the 407 specimens collected were of this

**Table 1. Number of mosquitoes taken in light traps at six localities, Hidalgo County, Tex., September 6–12, 1954**

| Species | Donna (4) | Edinburg (3) | McAllen (1) | Mission (8) | Pharr (2) | Weslaco (1) | Total (19) | Percent |
|---|---|---|---|---|---|---|---|---|
| *Psorophora confinnis* | 33 | 76 | 28 | 14 | 164 | 10 | 325 | 61.3 |
| *Culex quinquefasciatus* | 10 | 3 | | 50 | 9 | 1 | 73 | 13.7 |
| *Aedes sollicitans* | 50 | 1 | 12 | 3 | 1 | 2 | 69 | 13.0 |
| *Aedes vexans* | 31 | 7 | | | | | 38 | 7.1 |
| *Anopheles quadrimaculatus* | 8 | | | 1 | 2 | | 11 | 2.0 |
| *Culex coronator* | 5 | 4 | | | | | 9 | 1.6 |
| *Culex erraticus* | 1 | 1 | | | | | 2 | .3 |
| *Aedes scapularis* | | 1 | | | | | 1 | .1 |
| *Culex salinarius* | 1 | | | | | | 1 | .1 |
| *Psorophora signipennis* | | | | | 1 | | 1 | .1 |
| Total | 139 | 93 | 40 | 68 | 177 | 13 | 530 | 99.3 |

NOTE: Number of trap nights in parenthesis.

species. Next in abundance were *C. coronator* (7.1 percent) and *A. vexans* (5.1 percent).

Eleven species of mosquitoes (1,613 specimens) comprising 29 pools were tested for virus (table 4). Two strains of St. Louis virus were isolated from *C. quinquefasciatus* collected at Edinburg in September 1954.

### *Discussion*

*Culex tarsalis*, the mosquito reputed to be the principal vector of infectious encephalitis in western States, was not encountered during the entomologic investigation. It is considered uncommon in the Lower Rio Grande Valley. Hammon and associates (*2*) report that of approximately 23,000 mosquitoes gathered during encephalitis studies conducted in Cameron County, Tex., during the summer of 1942, only 60 were *C. tarsalis*. This is somewhat suprising since this species is abundant throughout the remainder of the State and conditions appear favorable for its development in this section.

The species is believed to be the principal vector of St. Louis encephalitis in California on the basis of the frequency of virus isolations. Reeves (*3*), Longshore and Stevens (*4*), and Lennette (*5*) report that 197 isolations of St. Louis virus have been made from *C. tarsalis* in California. There have been only three isolations of this virus from pooled *C. quinquefasciatus* mosquitoes collected in California (*3*). Investigations by Chamberlain and associates (*6*), comparing the potential of many common mosquitoes as vectors of eastern and western equine encephalitis, showed that *C. quinquefasciatus* was a very poor vector from the standpoint of threshold of infection, infection rate, and transmission rate. Even when the virus was highly concentrated in the blood of the host ($10^{7}$ to $10^{8.5}$), a negligible percentage became infected, and the few that became infected were poor transmitting agents.

**Table 2. Number of mosquitoes collected in shelters, Hidalgo County, Tex., September 6–14, 1954**

| Species | Alamo (1) | Edcouch (2) | Edinburg (8) | Hidalgo (3) | McAllen (3) | Mercedes (4) | Mission (7) | Pharr (4) | Weslaco (3) | Total (35) | Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Culex quinquefasciatus* | 50 | 144 | 341 | 25 | 69 | 24 | 256 | 66 | 47 | 1,022 | 94.3 |
| *Anopheles quadrimaculatus* | | 11 | 2 | 2 | | 24 | | | 5 | 44 | 4.0 |
| *Culex erraticus* | | | | | | 8 | | | 6 | 14 | 1.2 |
| *Anopheles crucians* | | | | | | 1 | | | | 1 | .1 |
| *Culex coronator* | | | 1 | | | | | | | 1 | .1 |
| *Psorophora confinnis* | | | | | | | | 1 | | 1 | .1 |
| Total | 50 | 155 | 344 | 27 | 69 | 57 | 256 | 67 | 58 | 1,083 | 99.8 |

NOTE: Number of collections in parentheses.

**Table 3. Number of mosquitoes taken in evening biting collections (human bait) at five localities, Hidalgo County, Tex., September 6–10, 1954**

| Species | Pharr 9/6/54 | Donna 9/7/54 | Mission 9/8/54 | Weslaco 9/9/54 | Mercedes 9/10/54 | Total | Percent |
|---|---|---|---|---|---|---|---|
| *Culex quinquefasciatus* | 3 | | 221 | 86 | 2 | 312 | 76.6 |
| *Culex coronator* | | 2 | | 4 | 23 | 29 | 7.1 |
| *Aedes vexans* | 1 | 18 | | | 2 | 21 | 5.1 |
| *Psorophora confinnis* | 1 | 9 | | | 3 | 13 | 3.0 |
| *Aedes scapularis* | | 8 | | 1 | | 9 | 2.2 |
| *Culex salinarius* | | | | | 9 | 9 | 2.2 |
| *Anopheles quadrimaculatus* | | 5 | | | 1 | 6 | 1.4 |
| *Aedes sollicitans* | | 4 | 1 | | | 5 | 1.2 |
| *Culex erraticus* | | 2 | | | 1 | 3 | .7 |
| Total | 5 | 48 | 222 | 91 | 41 | 407 | 99.5 |

NOTE: Collecting periods were 2 hours in length (from 7 to 9 p. m.).

**Table 4. Hidalgo County mosquitoes tested for viruses, 1954 outbreak of encephalitis**

| Species | Number tested | Number of pools | Number of positive pools (SLE) |
|---|---|---|---|
| *Culex quinquefasciatus* | 1,095 | 15 | [1] 2 |
| *Psorophora confinnis* | 326 | 3 | 0 |
| *Aedes sollicitans* | 69 | 1 | 0 |
| *Anopheles quadrimaculatus* | 55 | 3 | 0 |
| *Aedes vexans* | 38 | 1 | 0 |
| *Culex erraticus* | 16 | 1 | 0 |
| *Culex coronator* | 10 | 1 | 0 |
| *Aedes scapularis* | 1 | 1 | 0 |
| *Culex salinarius* | 1 | 1 | 0 |
| *Anopheles crucians* | 1 | 1 | 0 |
| *Psorophora signipennis* | 1 | 1 | 0 |
| Total | 1,613 | 29 | 2 |

[1] Edinburg.

Reeves (*3*) concludes, however, that vector mosquitoes do not require such high host titers to become infected with St. Louis virus as is the case with the other two viruses. Hammon and associates (*2*) report positive St. Louis encephalitis transmission experiments employing California strains of *C. quinquefasciatus*. During the notable epidemic of St. Louis encephalitis in the St. Louis area in 1933, circumstantial evidence implicated *Culex pipiens-quinquefasciatus* mosquitoes as vectors of the disease (*7*).

The isolation of virus from mosquitoes collected in the field does not definitely incriminate a species as a significant vector of the disease since any bloodsucking arthropod may temporarily carry the disease agent in a freshly ingested blood meal taken from an infected animal during a viremic phase. Coupled with epidemiological observations, however, the isolation of St. Louis virus from pooled *C. quinquefasciatus* during the Rio Grande Valley epidemic strongly suggests that it was the principal vector.

### Vector Control

In times of emergency, personnel and equipment of a number of different organizations and levels of government may join forces and function as a single organization. Most frequently operations are under the direct administrative supervision of local authorities, who are familiar with local needs and with the problems. Such was the case with the aid provided during this encephalitis epidemic in Hidalgo County. The county health officer served as overall director. Supervisory personnel responsible for planning and directing operations were from the Hidalgo County Health Unit, from the vector control section, bureau of sanitary engineering, Texas State Health Department, and from the Communicable Disease Center, Public Health Service. Equipment and insecticides were provided by Hidalgo County, the Texas State Health Department, and the CDC Disaster Aid Unit. The communicable Disease Center also assigned 18 temporary employees to insecticiding and inspection duties.

Since *C. tarsalis*, usually incriminated as the principal vector of encephalitis in the west, had not been found in the epidemic area, the insecticidal measures were directed against the larval and adult stages of all species of mosquitoes. For general larviciding, 5 percent DDT in diesel oil was applied with hand equipment as a mist on mosquito breeding areas. Roadside ditches and other accessible places were larvicided, however, with truck-mounted power spraying equipment dispersing 5 percent DDT emulsion. To control adults in urban areas of the county, space spraying and dusting were conducted during the hours of darkness. The spray was 5 percent DDT emulsion, and the dust contained 3 percent gamma isomer BHC. Although the large-scale use of dust for the control of adult mosquitoes within urban areas was apparently unprecedented, it resulted in an observed high degree of coverage and was therefore favored in this operation.

Space spraying and dusting were begun on the night of September 9 and hand larviciding on the following morning. Both spraying and dusting were done in all urban areas of the county and also in certain rural sections. Since much of the county is urbanized, a relatively large amount of the county was treated in this way. Larviciding was conducted in all urban and some rural areas. During the period September 9–23 both larvicidal and adulti-

cidal treatments were provided twice to the areas involved. Intermittent heavy showers complicated the problem by increasing the potential mosquito breeding areas and by hampering control operations. High winds also impeded operations.

## Results

In space spraying and dusting operations, 3,310 gallons of 5 percent DDT emulsion and 21,000 pounds of 3 percent gamma isomer BHC dust were applied to 20,225 acres. DDT-diesel oil larvicide in the amount of 1,312 gallons was applied on 263 acres of both actual and potential mosquito breeding area. In all, 1,256 man-hours of labor were expended. A population of approximately 72,000 within 12 incorporated areas of the county received the protection of this routine work. Also, an unestimated additional number of persons in rural areas derived benefits from nonroutine work, mostly larviciding.

Inspections of resting places of adult mosquitoes and larval habitats disclosed that the populations had been reduced to satisfactory levels.

## Summary

An entomological survey and mosquito control operations were conducted during the late summer of 1954 in connection with an outbreak of encephalitis in the Lower Rio Grande Valley of Texas.

Larval and adult collections showed that the predominant mosquito species present in the affected area were *Culex quinquefasciatus* and *Psorophora confinnis*.

Eleven species of mosquitoes (1,613 specimens) comprising 29 pools were tested for virus. Two strains of St. Louis encephalitis virus were isolated from *Culex quinquefasciatus* collected at Edinburg, Tex., in September 1954.

Mosquito control operations were carried on within the area from September 9 to 23. They consisted of adulticidal treatment in urban areas with 5 percent DDT spray or 3 percent gamma isomer BHC dust, and larvicidal treatment in all urban and some rural areas with 5 percent DDT emulsion. A human population of approximately 72,000 within 12 incorporated cities and towns received protection from this work. Inspections disclosed that mosquito populations had been reduced to satisfactory levels.

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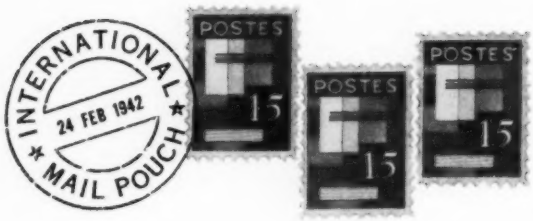



*These paragraphs, based on overseas reports from public health personnel with missions and field parties of the International Cooperation Administration, give a glimpse into health work abroad. Most of the original material appears in an administrative publication distributed by the Public Health Division of the ICA.*

## *Training Midwives*

Teaching the untrained midwives who deliver most of the babies in some 40,000 Iranian villages is an important part of our program. The village midwife is a respected member of the community who usually inherits her profession.

Midwives are taught what to do and what not to do. They no longer put *surmeh* (mascara) on a new baby's eyes or *khakestar* (a mixture of oil and ashes which can cause tetanus) on the new baby's umbilical cord. They refer their "cases" to our prenatal classes and their babies to our "well baby clinics." They are our "health workers" in the villages.

Our course includes classes in management of labor and delivery, postpartum care, environmental sanitation, nutrition for mothers and babies, and personal hygiene. Attendance is by written request from the Ministry of Health. Supervision is continuous throughout the 3 or 4 months of instruction, aided at times, and in Isfahan especially, by physicians and *behyars* (public health nurse aides).

Graduates are presented with special midwifery bags and told to report every 2 weeks even if there have been no deliveries in that period.

By visiting the midwife in her home, we help her set an example of good health for her village. Each midwife has a "family folder." This means that she is registered at the health center, has had a physical examination, is subject to various health tests, and is taught the meaning and practice of good health habits.

Iranian mothers and children are fortunate in being cared for by these women.

—HELEN J. BAKHTIAR, R.N., *public health nurse consultant, United States Operations Mission, Iran.*

## *The Waters of Illampu*

To a 100-year-old *Amauta* (Aymara sage), potable water for the village of Warisata was the dream of a long lifetime. Warisata nestles in the foothills of Bolivia's highest peak, snow-covered Illampu. The water supply for the Aymaras, an extensive gravity system with conduits made from asbestos and locally produced *mara* (mahogany) is an enviable achievement in sanitary engineering skill.

After pleasant hours of speechmaking near the elevated storage tank, a drinking ceremony was held at the village plaza fountain. Saluds were exchanged with the Ministro de Higiene y Salubridad, invited diplomats, and the village sage. With tears in his eyes, the *Amauta* related that his youthful dream of bringing the pure waters of Illampu to his people had at last come true through the kindness of his North American friends.

—GEORGE ADAMS, M.D., M.P.H., *formerly chief of the health, welfare, and housing field party, United States Operations Mission, Bolivia.*

## *Schistosomiasis*

The harvesting of the romaine lettuce crop in Egypt will accelerate the invasion of snails into the Warraq El Arab project area. Snails are particularly fond of romaine lettuce. They quickly attach themselves to the floating leaves, so that the hundreds of stalks, washed daily during early Spring in the Sawahil and Bashtil canals, are likely to disperse aquatic snails throughout an irrigation system.

We have installed palm-leaf snail traps at 100-meter stations along the canals and drains. There are approximately 20 traps to a kilometer. The first dip-net survey of 150 kilometers yielded a small number of *Bulinus truncatus* juveniles, which were treated immediately with sodium pentachlorophenate. Findings from the first examination of the snail traps will determine our course of action.

—ANTHONY DONOVAN, M.D., *chief, Health and Sanitation Division, United States Operations Mission, Egypt.*

*Contrary to popular impression, diphtheria has not ceased to be of public concern in the Nation. Its occurrence and distribution suggest continued vigilance.*

# Present Distribution of Diphtheria in the United States

HELEN A. MOORE, M.D., and GRACE I. LARSEN, R.N.

AS a disease of public health importance, the annual total of approximately 2,000 cases places diphtheria before brucellosis, encephalitis, psittacosis, typhoid fever, or typhus fever, or any combination of the less common communicable diseases, such as malaria, human rabies, or anthrax.

At the same time, 2,000 cases of diphtheria yearly, distributed quite unequally, do not constitute a prevalence which gives the disease great preeminence in the minds of physicians or public health workers. Diagnostic acumen and laboratory and public health competency are now being maintained with difficulty or not at all. Such a diminution in awareness of and ability to diagnose diphtheria seems particularly unfortunate. The present low incidence of the disease suggests that this would be a propitious time to intensify all preventive measures and so assist in placing diphtheria in the museum along with cholera, yellow fever, and smallpox.

If diphtheria is to be attacked more appropriately and more vigorously than in the past, the present features of the problem must be known in some detail. The national reviews of Collins, Anderson, and Dauer are now some years in the past (*1–3*). Later discussions have dealt primarily with local problems (*4–6*). To bring the national picture up to date we have added to a résumé of earlier data reports for the most recent years.

Data on the occurrence of diphtheria cases and deaths were obtained primarily from publications of the Public Health Service's National Office of Vital Statistics: Morbidity and Mortality Weekly Reports and their annual supplements, and Vital Statistics of the United States. More detailed information was obtained from current communicable disease reports prepared by States for internal use and from the annual communicable disease statistics published by most States. Additional details were collected by personnel of the Public Health Service's Communicable Disease Center in connection with field assignments which dealt directly or indirectly with diphtheria. The assembling and review of such data are continuing functions of the Surveillance Section of the center.

### National Morbidity and Mortality Rates

Annual morbidity and mortality rates for diphtheria have fallen sharply since 1933 and have not increased, even for a single year, since

*Dr. Moore is chief of the Diphtheria Unit, Surveillance Section, and Miss Larsen was a nurse in this unit of the Epidemiology Branch, Communicable Disease Center, Public Health Service. Miss Larsen is now nursing consultant in charge of the venereal disease training program, bureau of nursing, New York City Health Department.*

1945 (fig. 1, table 1). In distinct contrast is the case fatality rate, which remains at 6 to 7 percent. Neither advances in the quality and availability of medical care nor the effect of immunization has been reflected in a lowered fatality rate for diphtheria. Any improvement has been offset by other adverse factors or by a failure to detect and report nonfatal cases.

The decline in case rates has not been equal and simultaneous in all areas of the United States. Recent case rates for major geographic divisions are shown in figure 2. Rates in the South Atlantic, East South Central, and West South Central States have been noticeably higher than in other geographic divisions; between 1950 and 1954, 69.6 percent of the diphtheria cases in the country occurred in these areas. A slight exception to the general pattern occurred in 1953, when an outbreak of diphtheria in Idaho elevated the case rate for the Mountain States.

This concentration of diphtheria cases in the southern States has been developing since about 1930. In 1936 Dauer (7) noted that diphtheria mortality in these States had declined only 40 percent between 1918–22 and 1928–32, whereas in the northern and western States the decline had been 60 to 70 percent. In the earlier period the highest rates were recorded in the North Atlantic and East North Central States; in the later period the East South Central and West South Central States had rates almost twice as high as those areas previously at the top of the list. In the years since 1932 rates throughout the country have fallen farther but the north-south difference has remained prominent.

### Experience of States

During the period 1950–54 all of the southern States had annual diphtheria case rates higher than 2.3 per 100,000, the average annual rate for the United States (fig. 3). In Alabama and South Carolina the rates were almost four times the national average.

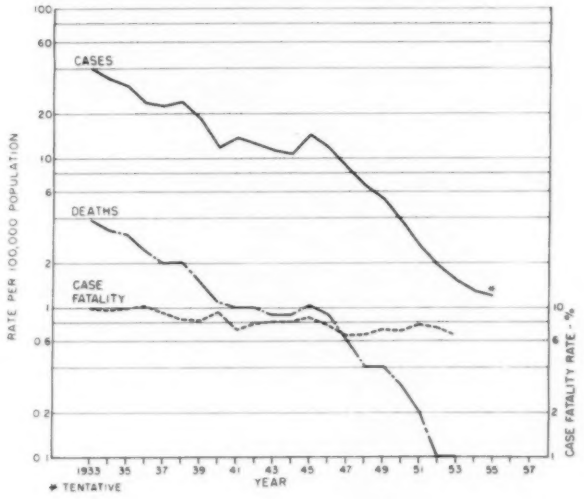
**Table 1. Reported diphtheria cases and deaths, United States, 1933–55**

| Year | Population (in thousands) | Number | | Rate per 100,000 population | | Case fatality (percent: deaths/cases) |
|---|---|---|---|---|---|---|
| | | Cases [1] | Deaths [1] | Case | Death | |
| 1933 | 125, 579 | 50, 462 | 4, 937 | 40. 1 | 3. 9 | 9. 8 |
| 1934 | 126, 374 | 43, 156 | 4, 159 | 34. 1 | 3. 3 | 9. 6 |
| 1935 | 127, 250 | 39, 226 | 3, 901 | 30. 8 | 3. 1 | 9. 9 |
| 1936 | 128, 053 | 30, 018 | 3, 065 | 23. 4 | 2. 4 | 10. 2 |
| 1937 | 128, 825 | 28, 536 | 2, 637 | 22. 1 | 2. 0 | 9. 2 |
| 1938 | 129, 825 | 30, 508 | 2, 556 | 23. 5 | 2. 0 | 8. 4 |
| 1939 | 130, 880 | 24, 053 | 1, 997 | 18. 3 | 1. 5 | 8. 3 |
| 1940 | 131, 936 | 15, 536 | 1, 457 | 11. 8 | 1. 1 | 9. 4 |
| 1941 | 133, 058 | 17, 987 | 1, 293 | 13. 5 | 1. 0 | 7. 2 |
| 1942 | 133, 752 | 16, 260 | 1, 273 | 12. 4 | 1. 0 | 7. 8 |
| 1943 | 133, 971 | 14, 811 | 1, 196 | 11. 1 | . 9 | 8. 0 |
| 1944 | 132, 622 | 14, 150 | 1, 145 | 10. 7 | . 9 | 8. 0 |
| 1945 | 132, 137 | 18, 689 | 1, 598 | 14. 1 | 1. 2 | 8. 5 |
| 1946 | 139, 893 | 16, 354 | 1, 259 | 11. 6 | . 9 | 7. 7 |
| 1947 | 143, 375 | 12, 405 | 799 | 8. 6 | . 6 | 6. 4 |
| 1948 | 146, 045 | 9, 610 | 634 | 6. 6 | . 4 | 6. 6 |
| 1949 | 148, 558 | 8, 027 | 574 | 5. 4 | . 4 | 7. 2 |
| 1950 | 151, 228 | 5, 931 | 410 | 3. 9 | . 3 | 6. 9 |
| 1951 | 153, 383 | 3, 983 | 302 | 2. 6 | . 2 | 7. 6 |
| 1952 | 155, 767 | 2, 960 | 217 | 1. 9 | . 1 | 7. 3 |
| 1953 | 158, 320 | 2, 355 | 156 | 1. 5 | . 1 | 6. 6 |
| 1954 | 161, 183 | 2, 041 | ---------- | 1. 3 | ---------- | ---------- |
| 1955 [2] | 164, 280 | 2, 039 | ---------- | 1. 2 | ---------- | ---------- |

[1] Cases and deaths for death-registration States. Registration complete in 1933.
[2] Tentative figures.

SOURCE: Cases, 1933–55, The Notifiable Diseases; 1955 cumulated weekly reports. Deaths, 1933–55, Annual Summary, Vital Statistics of the United States, National Office of Vital Statistics.

**Figure 1. Reported case rates, death rates, and case fatality rates for diphtheria in the United States, 1933–55.**




Comparison of death rates for individual States in the same order shows considerable irregularity in death rates from diphtheria, due to variations in case fatality rates (fig. 4). Apparently, diphtheria has not been unduly fatal in the States with the highest case rates; in general, diphtheria fatality rates are as high or higher in all other parts of the country. Unexpectedly high rates, based on significant numbers of cases and deaths, are encountered in Washington, Oregon, and California, where diphtheria is occurring in adults. On the other hand, the high rates recorded for Vermont, Connecticut, and the District of Columbia are based on extremely small numbers and have little significance.

**Figure 2. Reported diphtheria cases per 100,000 population in the United States, by major geographic division, 1949–55.**

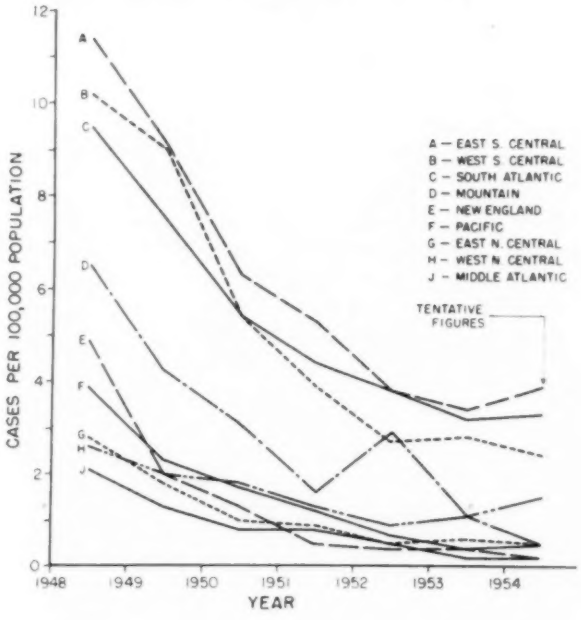
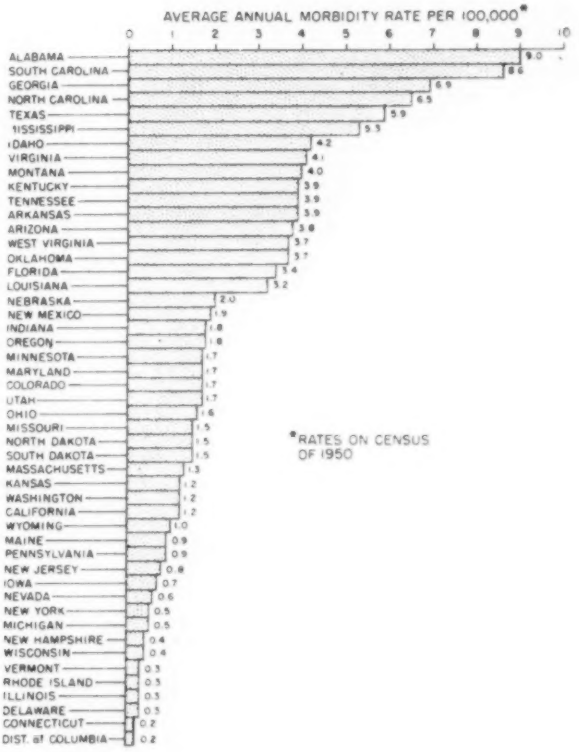



**Figure 3. Diphtheria case rates in the United States, by State, 1950–54.**




The State of Idaho is distinguished by a low mortality rate and a very low diphtheria case fatality rate. A large proportion (87 of 126) of the diphtheria cases for the 5 years 1950–54 were reported from a localized outbreak in 1953. During the outbreak, heightened awareness of diphtheria undoubtedly stimulated diagnostic activity and the reporting of mild cases which might have escaped detection at other times. Also, the public health and community resources of the area were completely mobilized to combat the disease. It would be much too cynical to attribute this low fatality rate entirely to

**Figure 4. Diphtheria death rates in the United States, by State, 1950–54.**


"over-reporting" of nonfatal cases. Conversely, one might hold that, given the same degree of alertness, a case fatality rate of 1.6 percent is achievable almost anywhere.

### Distribution of Diphtheria in 1955

In 19 of the first 26 weeks of 1955, the weekly incidence of diphtheria was the same as or lower than that of 1954, and the total of reported cases at midyear was 717 as compared with 872 cases in the same period of 1954. Incidence was well below the 5-year median (fig. 5), with the exception of the first week in January. The seasonal low was reached about the fourth week in July.

The diphtheria season began early in August with a fairly sharp outbreak in Alabama, followed almost immediately by an episode in South Carolina, which continued throughout the autumn. During August and September reported cases exceeded the 5-year median on several occasions.

A sharp peak in incidence of diphtheria is noted in November and early December, when an outbreak was in progress in Nebraska. At the same time, two counties in Texas and two in Alabama reported an undue number of cases. This combination, added to the usual seasonal increases, produced the sharp peak in the 48th and 49th weeks of 1955.

During the latter half of the year, 1,327 cases (tentative) were reported, an excess of 110 over the same period in 1954. The number of currently reported cases exceeded the 5-year median in 5 of the last 26 weeks.

In 1955, reported diphtheria cases were concentrated in the southern States (*8*). When this distribution is displayed as rates, the pattern is the same as that which has been seen quite consistently in recent years (fig. 6). The relatively high rates in South Dakota and Nebraska are attributable to localized sharp outbreaks. In almost every year some State in the northern and western areas has such an experience. The same State is not usually affected in 2 successive years.

### Outbreaks in 1955

There is no standard numerical definition of a diphtheria "outbreak." Therefore, to facilitate discussion of the areas where the prevalence of diphtheria was considerably different from prevalence of the disease in the country as a whole, an arbitrary definition has been chosen. For convenience, and to suit the present low incidence of the disease, "outbreak" here indicates 10 or more cases in a county, producing a county rate of 20 per 100,000 popula-

**Figure 5. Reported diphtheria cases in the United States, by week, 1955.**

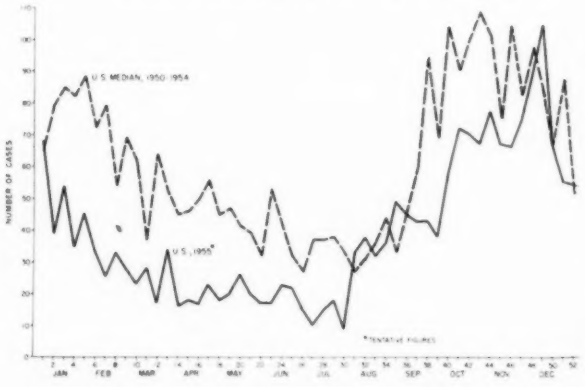


**Table 2. Diphtheria outbreaks in the United States, 1955**

| State | County | Cases | | Date | Remarks |
|---|---|---|---|---|---|
| | | Number | Rate [1] | | |
| Minnesota | Beltrami | 13 | 52.1 | January–February | Rural white population. 5 of 13 cases were in adults.[2] |
| South Dakota | Charles Mix | 14 | 90.0 | March–April | |
| Kentucky | Meade | 24 | 254.8 | April–June | Rural white population. 8 of 24 cases were in adults.[2] 76 percent of school children and 46 percent of preschool children currently and adequately immunized; 38–67 percent of adults Schick positive. |
| Alabama | Russell | 37 | 91.7 | July–August | Rural and urban nonwhite populations. |
| South Carolina | Charleston | 99 | 44.7 | July–November | Rural and urban nonwhite populations. |
| James Island | | 52 | [3] 776.2 | July–October | Focus of outbreak was on a coastal island, not in the city of Charleston. 50 percent of school children and 42 percent of preschool children adequately immunized. |
| Alabama | Dallas | 17 | 30.2 | July–October | |
| South Carolina | Dillon | 10 | 32.3 | August–October | |
| Alabama | Pike | 11 | 35.9 | August–November | |
| South Carolina | Georgetown | 12 | 37.8 | September | |
| Georgia | Sumter | 17 | 70.2 | September–October | |
| Alabama | Sumter | 16 | 67.8 | September–October | |
| North Carolina | Hoke | 11 | 69.8 | September–November | |
| Georgia | Harris | 13 | 115.4 | October–November | Rural nonwhite population. 11.5 percent of nonwhite school children currently and adequately immunized but 84 percent Schick negative. |
| Georgia | Dougherty | 10 | 22.9 | October–December | |
| Texas | Cameron | 56 | 44.7 | October–December | |
| Texas | Hidalgo | 38 | 23.7 | October–December | Primarily in the Latin-American population. |
| Nebraska | Douglas | 63 | 22.4 | October–December | Primarily in the city of Omaha. |
| Alabama | Tuscaloosa | 27 | 28.7 | November–December | |
| Florida | Lee | 10 | 42.7 | November–December | |

[1] Per 100,000 of county population, census of 1950.
[2] 25 years of age and over.
[3] Per population of census area, 1950.

tion or higher, on an annual basis. We are fully aware that this definition may exclude a fairly sharp localized outbreak in an institution or neighborhood which would not lead to a rate of 20 per 100,000 in a populous county. This rate should be a departure from the rate usually observed in the county in recent years.

With this definition, 19 outbreaks of diphtheria occurred in 1955. They are shown by order of occurrence in table 2, together with some observations by field personnel of the Communicable Disease Center.

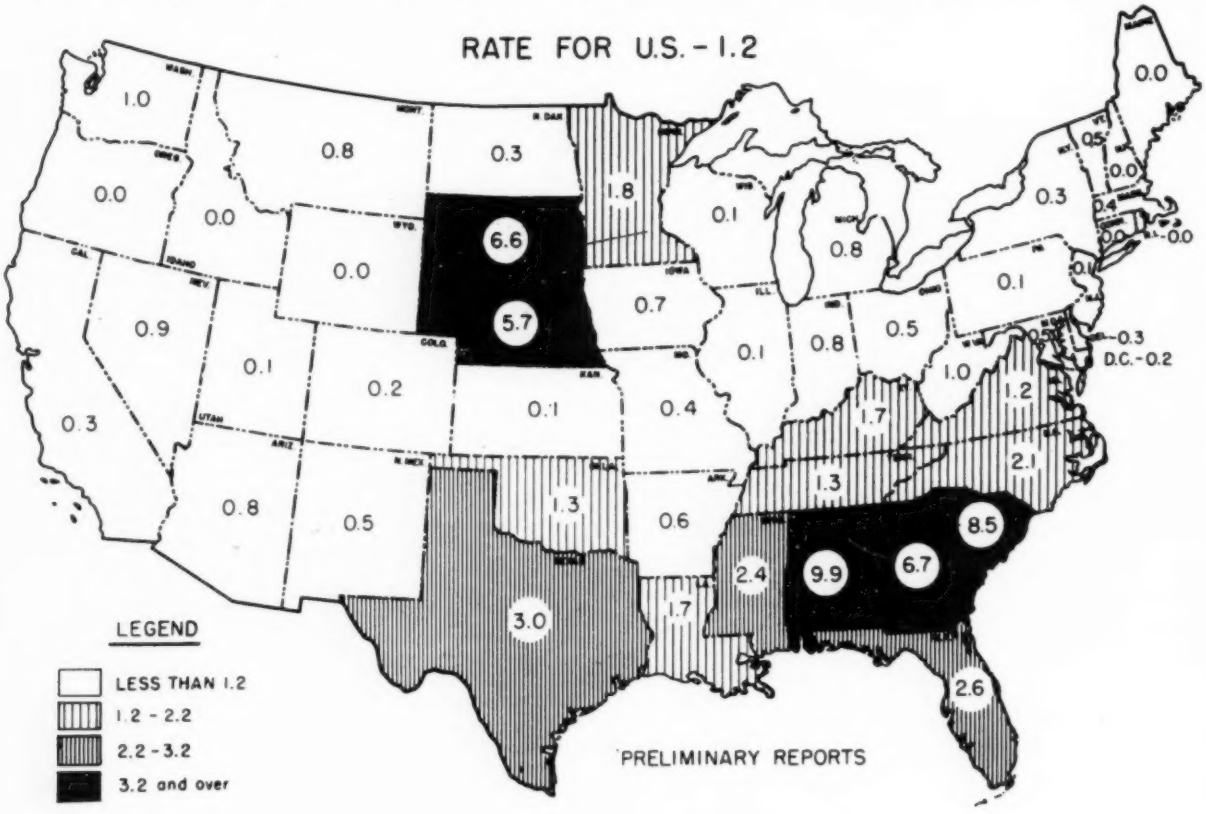
The wide geographic distribution of these episodes, from upper Minnesota to lower Florida and Texas, is noteworthy, as well as the wide distribution with respect to the calendar. The populations affected were found to be quite diverse wherever information on diphtheria outbreaks was obtained.

## Summary

1. While diphtheria case rates and death rates have decreased in recent years, the case fatality rate has changed little. A need to inquire into the promptness of diagnosis and the completeness of reporting is suggested.

2. The persistent diphtheria problem in the United States is tending to localize in the South Atlantic, East South Central, and West South Central States.

**Figure 6. Reported diphtheria cases per 100,000 population in the United States, by State, 1955.**




3. Outbreaks of diphtheria have been observed in these areas but not exclusively so. Localized sharp outbreaks have occurred in recent years in Idaho, Nebraska, Minnesota, South Dakota, and other northern and western States.

4. During 1955, outbreaks of diphtheria were observed in diverse regions and in all months of the year. The populations affected were variously white, nonwhite, and Latin-American. Both rural and urban areas were involved.

• • •

*Tables giving the reported diphtheria cases in the United States and the rate per 100,000 population, for major geographic divisions, 1949–55, and for each State, 1950–54, are available from Dr. Moore.*

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# Mortality Experience Among the Japanese in the United States, Hawaii, and Japan

TAVIA GORDON

MORTALITY among the Japanese in continental United States is similar in many respects to that among the white population. However, mortality from the chronic diseases, particularly the cardiovascular diseases, presents some striking contrasts. In comparison with the white population, the death rates for diseases of the heart are quite low, while those for vascular lesions affecting the central nervous system are rather high. The same differential, but in a more exaggerated form, is evident among the Japanese in Hawaii and for Japan itself.

A more complete description of mortality among Americans of Japanese birth or descent in continental United States follows. This description is based on unpublished data for the years 1949–52 from the National Office of Vital Statistics of the Public Health Service. For comparison, data are also presented for the Japanese in Hawaii (*1–3*) and for Japan (*4, 5*), as well as for the white population of continental United States (*6*). In addition, some historical and demographic material, enough, it is hoped, to place the main body of data in perspective, is included.

The data described in this paper are not, of course, appropriate for disentangling the various genetic and cultural factors that may affect the mortality experience of these various groups, and they should not be taken as doing that. Furthermore, there is usually some uncertainty about the certification of cause of death, especially for the chronic diseases. When the mortality data of different groups are compared, as in this paper, the shadow of doubt may be rather large. Nevertheless, mortality data can provide a groundwork for a more direct inquiry into causative factors. In any event, they are of interest in themselves.

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## Demographic Characteristics

In the United States in 1950, the Japanese were primarily city dwellers (*7*). Some 71 percent of all Japanese in this country were urban residents, most of them living within a few metropolitan areas. Yet, almost a third of all employed Japanese men (some of them nominally urban residents of the Los Angeles metropolitan area) were classified to the major occupation groups of farmers, farm managers, farm laborers, or farm foremen.

Geographically, the Japanese were concentrated on the west coast. Nearly 60 percent lived in California and 27 percent lived in the Los Angeles metropolitan area in 1950.

The level of education among the Japanese in the United States, in terms of number of school years completed, was above average. In comparison with the white population, their median income was low, they tended to marry later, and a larger proportion were single. There were more Japanese men than Japanese women in the United States, especially at the older ages. More than one-fourth of all Japanese Americans were born in Japan.

## General Mortality

The mortality experience of the Japanese in the United States may be described as favorable.

Specifically, that means that death rates among the Japanese are lower than among the white population. This may be seen from table 1, which gives death rates by age and sex for the two populations. With two minor exceptions, for boys 5–14 years and women 35–44 years, age-specific death rates are lower among the Japanese of both sexes than among the whites.

Missing from this picture is the infant mortality rate, a historic index of public hygiene and medical care. In 1950, 19.1 Japanese infants died for every 1,000 born, a rate found only in well-favored white groups. The rate for the white population as a whole was 26.8.

These comparisons are between the white population and the Japanese population throughout the continental United States. It will be recognized, however, that the Japanese population tends to concentrate in certain localities and in certain occupation groups, and, indeed, that it differs from the white population in a number of demographic characteristics. If the comparisons could be restricted to the specific areas where the Japanese reside or to a white population with demographic characteristics similar to the Japanese, the mortality differentials might possibly be somewhat reduced. It is unlikely, however, that they would be reduced very much. Actually, it is possible that the specific differentials are understated: The age-specific death rates for the white population of California, the State where the largest proportion of the Japanese American population is concentrated, were in general above those for the white population of all the States in 1950.

There is one demographic factor that warrants special mention. This is the tendency, especially in earlier decades, for the Japanese

**Table 1. Number of deaths and death rates for white and Japanese populations of continental United States, Japanese of Hawaii, and Japan, by age and sex, for specified years**

| Age group (years) | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | Japanese | | | White, United States, 1950 | Japanese | | | White, United States, 1950 |
| | United States, 1949–52 | Hawaii, 1949–51 | Japan, 1951 | | United States, 1949–52 | Hawaii, 1949–51 | Japan, 1951 | |
| | Number of deaths | | | | | | | |
| All ages | 2,749 | 1,828 | 432,517 | 731,366 | 916 | 1,070 | 406,449 | 544,719 |
| 0–4 | 183 | 171 | 107,800 | 55,516 | 151 | 126 | 94,699 | 40,705 |
| 5–14 | 29 | 26 | 13,327 | 7,298 | 14 | 25 | 12,200 | 4,704 |
| 15–24 | 45 | 47 | 22,972 | 14,769 | 35 | 32 | 20,979 | 7,024 |
| 25–34 | 95 | 73 | 23,139 | 19,323 | 61 | 54 | 25,533 | 12,235 |
| 35–44 | 80 | 63 | 25,828 | 36,293 | 56 | 61 | 24,743 | 22,915 |
| 45–54 | 182 | 141 | 39,877 | 77,150 | 133 | 114 | 29,695 | 42,994 |
| 55–64 | 482 | 321 | 62,285 | 142,419 | 212 | 179 | 44,532 | 79,803 |
| 65 and over | 1,653 | 986 | 137,289 | 378,003 | 254 | 479 | 154,068 | 334,016 |
| | Death rate per 100,000 population | | | | | | | |
| All ages | 898.9 | 653.5 | 1,042.4 | 1,089.5 | 352.8 | 390.4 | 943.5 | 803.3 |
| 0–4 | 626.0 | 503.8 | 1,805.7 | 766.3 | 524.6 | 389.3 | 1,651.5 | 586.5 |
| 5–14 | 73.8 | 51.0 | 146.6 | 67.2 | 38.2 | 50.8 | 137.6 | 45.1 |
| 15–24 | 86.9 | 88.6 | 276.9 | 152.4 | 70.3 | 55.3 | 254.0 | 71.5 |
| 25–34 | 132.7 | 135.4 | 429.8 | 185.3 | 94.9 | 94.8 | 401.0 | 112.8 |
| 35–44 | 293.0 | 199.3 | 555.9 | 380.9 | 250.6 | 213.1 | 483.7 | 235.8 |
| 45–54 | 711.5 | 695.8 | 1,055.8 | 984.5 | 487.1 | 535.2 | 803.4 | 546.4 |
| 55–64 | 1,760.9 | 1,890.1 | 2,428.3 | 2,304.4 | 985.5 | 1,126.4 | 1,695.2 | 1,293.8 |
| 65 and over | 4,912.6 | 5,207.8 | 7,791.7 | 7,051.9 | 2,804.8 | 4,060.7 | 6,379.6 | 5,554.6 |

**Table 2. Average death rates [1] for selected causes by sex for specified age groups: Japanese in continental United States, 1949–1952**

| Cause of death [2] | Males, by age group [3] | | | | Females, by age group [4] | | | |
|---|---|---|---|---|---|---|---|---|
| | 35–44 | 45–54 | 55–64 | 65–74 | 35–44 | 45–54 | 55–64 | 65–74 |
| All causes | 293. 0 | 711. 5 | 1, 760. 9 | 4, 077. 2 | 250. 6 | 487. 1 | 985. 5 | 2, 536. 2 |
| Tuberculosis, all forms (001–019) | 29. 3 | 70. 4 | 142. 5 | 253. 9 | 35. 8 | 22. 0 | 13. 9 | 40. 3 |
| Infective and parasitic diseases (020–138) | 0 | 7. 8 | 32. 9 | 50. 1 | 0 | 3. 7 | 4. 6 | 26. 8 |
| Malignant neoplasms (140–205) | 43. 9 | 160. 3 | 427. 4 | 976. 4 | 71. 6 | 124. 5 | 357. 9 | 469. 7 |
| Diabetes mellitus (260) | 0 | 3. 9 | 40. 2 | 57. 2 | 0 | 7. 3 | 4. 6 | 53. 7 |
| Vascular lesions affecting CNS (330–334) | 22. 0 | 54. 7 | 230. 2 | 579. 4 | 22. 4 | 106. 2 | 199. 9 | 496. 5 |
| Diseases of heart (410–443) | 73. 2 | 199. 4 | 562. 6 | 1, 291. 1 | 22. 4 | 106. 2 | 237. 1 | 1, 006. 4 |
| Chronic rheumatic heart disease (410–416) | 3. 7 | 7. 8 | 3. 7 | 32. 2 | 0 | 7. 3 | 13. 9 | 26. 8 |
| Arteriosclerotic and degenerative heart disease (420–422) | 51. 3 | 152. 5 | 464. 0 | 1, 083. 7 | 17. 9 | 47. 6 | 153. 4 | 711. 2 |
| Other diseases of heart (430–434) | 7. 3 | 7. 8 | 11. 0 | 21. 5 | 0 | 7. 3 | 0 | 26. 8 |
| Hypertension with heart disease (440–443) | 11. 0 | 31. 3 | 84. 0 | 153. 8 | 4. 5 | 43. 9 | 69. 7 | 241. 5 |
| Hypertension without mention of heart (444–447) | 0 | 3. 9 | 3. 7 | 28. 6 | 4. 5 | 3. 7 | 9. 3 | 13. 4 |
| Influenza and pneumonia (480–493) | 3. 7 | 3. 9 | 43. 8 | 107. 3 | 0 | 11. 0 | 27. 9 | 67. 1 |
| Bronchitis (500–502) | 0 | 0 | 0 | 7. 2 | 0 | 0 | 0 | 0 |
| Ulcer of stomach and duodenum (540,541) | 0 | 15. 6 | 7. 3 | 89. 4 | 0 | 3. 7 | 9. 3 | 26. 8 |
| Gastritis, etc. (543, 571, 572) | 3. 7 | 0 | 7. 3 | 10. 7 | 0 | 0 | 0 | 0 |
| Cirrhosis of liver (581) | 7. 3 | 23. 5 | 14. 6 | 60. 8 | 4. 5 | 0 | 4. 6 | 13. 4 |
| Nephritis and nephrosis (590–594) | 14. 6 | 27. 4 | 14. 6 | 25. 0 | 4. 5 | 22. 0 | 27. 9 | 26. 8 |
| Symptoms, senility, and ill-defined conditions (780–795) | 0 | 0 | 3. 7 | 17. 9 | 4. 5 | 0 | 0 | 0 |
| Accidents and violence (E810–E999) | 69. 6 | 97. 7 | 142. 5 | 225. 3 | 49. 2 | 43. 9 | 41. 8 | 93. 9 |
| All other | 25. 6 | 43. 0 | 87. 7 | 296. 8 | 31. 3 | 33. 0 | 46. 5 | 201. 3 |

[1] Rates per 100,000 population in each specified group as of April 1, 1950.
[2] Numbers after causes are category numbers of the sixth revision of the International Lists, 1948.
[3] Total numbers of deaths for specified age groups were: 80, 182, 482, 1,140.
[4] Total numbers of deaths for specified age groups were: 56, 133, 212, 189.

NOTE: For more detailed data on causes of death, see Documentation Note at end of the paper.

born in Japan to return home to pass their later years. It is conceivable that this is a selective process that would affect death rates in the United States, either raising them or lowering them. Lacking data on this score, it is impossible to be certain, but, in any event, this process would probably have less effect on the rates around 1950 than at earlier periods.

It is worth noting that the generally favorable mortality experience for the Japanese in the United States is nothing new. Although there were naturally some differences in detail, mortality for this group was relatively low in 1940 and in 1930. Were this not the case, the small size of the Japanese population in the United States, and consequently the small number of deaths reported, might raise some doubts, on grounds of the variability of small numbers, with respect to the reported death rates. As it is, there is little question that the death rates give a generally reliable indication of the force of mortality in the Japanese population.

### Deaths by Cause

For some causes of death, experience among the Japanese in the United States (table 2) is similar to that among the white population. Maternal mortality is low: There were only 11 deaths from maternal causes among the Japanese in 1949–52 while births in that period numbered 15,224. Few deaths were reported for the infectious diseases, with the exception of tuberculosis. Mortality from influenza and pneumonia was very similar to the mortality from those causes reported for the white population. Syphilis mortality is apparently comparable, although the number of deaths reported for the Japanese was too low for precise comparison.

For other causes of death, mortality among the Japanese of the United States differs significantly from that for the white population. The Japanese have a somewhat lower accident mortality, except in childhood. Homicide is a negligible cause of death; only 4 Japanese died from this cause during 1949–52. Suicide, on the other hand, looms larger among the Japanese. While suicide rates for Japanese men are very like those for white men, the rates for Japanese women are well above those for white women, especially in the age groups 35 and over.

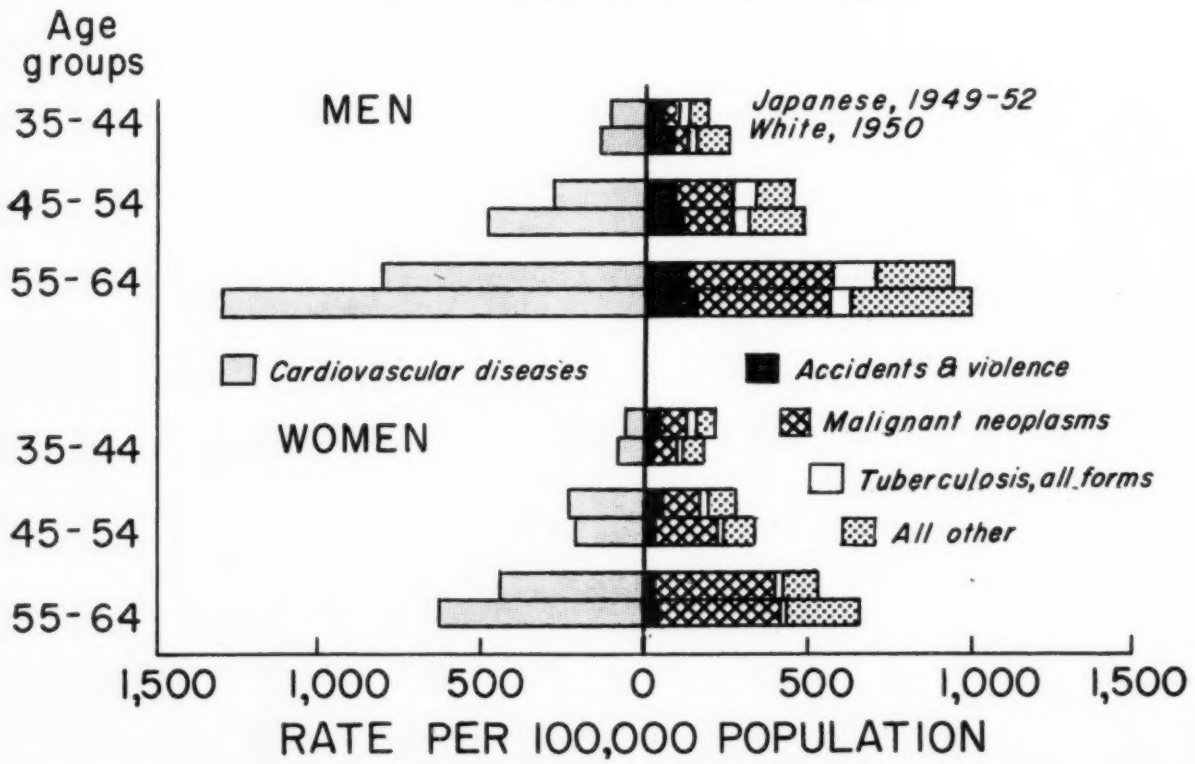
It is in the area of the chronic diseases, however, that the contrast between mortality for the Japanese of the United States and for the white population is most striking. Deaths from diabetes are uncommon among Japanese women in the United States in contrast to mortality from this cause among white women. On the other hand, tuberculosis mortality is higher among the Japanese than the white population, although not nearly so high as for Negroes. Although death rates for malignant neoplasms are similar in the white and Japanese groups, there are differences in rates for the various sites (*8*).

### Cardiovascular Diseases

Among the chronic diseases, the cardiovascular diseases provide the most dramatic contrast. Figures 1 and 7 show the large differentials between the Japanese and white populations of the United States in mortality from diseases of the cardiovascular system. In these graphs cardiovascular mortality is presented in the context of the total mortality for each of the specific age groups. Death rates for the cardiovascular diseases are presented to the left of the origin, and death rates for other causes, divided into tuberculosis (all forms), malignant neoplasms, accidents and violence, and "all other," are presented to the right.

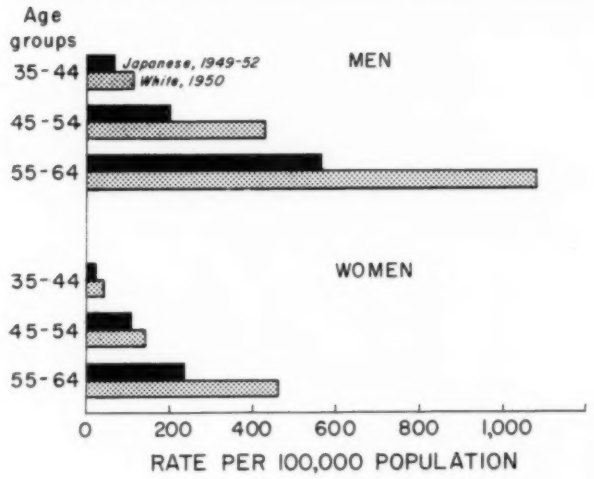
Death rates for the noncardiovascular causes as a whole tend to be a little lower for the Japanese than for the white population of the United States. For men aged 45 through 74, the excess of the cardiovascular death rate for

**Figure 1. Death rates by age and sex for major components of mortality: adult Japanese and white populations of continental United States.**



the white population over the rate for the Japanese is larger than the reported rate for malignant neoplasms, which are the major noncardiovascular cause of death in these age groups. The excess is also larger than the rate for the large group of causes classified as "all other" in figures 1 and 7.

**Figure 2. Death rates by age and sex for diseases of the heart: Japanese and white populations of continental United States.**




There does not appear to be any way of closing the large gap between the cardiovascular rates for the two groups by shifting assignments of cause of death. Such reassignment would either result in reducing death rates for the noncardiovascular causes to implausible levels for the Japanese or in increasing the rates for the noncardiovascular causes to equally implausible levels for the whites. It seems clear that cardiovascular mortality, especially for adult men, is really substantially lower among the Japanese population of the United States than among the white.

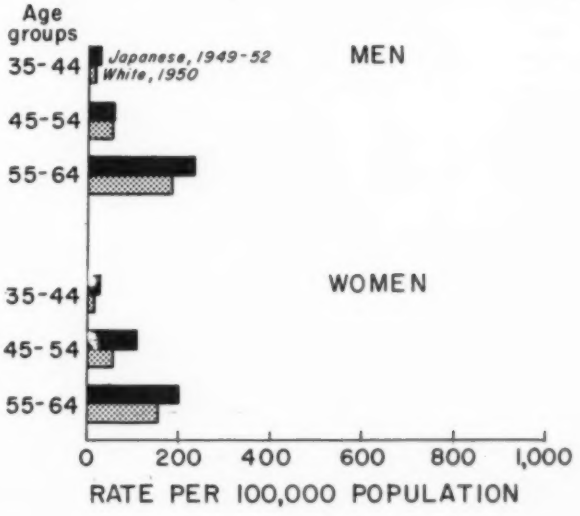
When the cardiovascular diseases are examined in detail, the differences are seen to arise from diseases of the heart, with death rates for this cause much lower for Japanese than for whites (fig. 2). Death rates for vascular lesions affecting the central nervous system are actually somewhat higher among the Japanese (fig. 3). Indeed, for Japanese women aged 45–54 the death rate for this cause more than compensates for the low death rate for diseases of the heart so that the total cardiovascular death rate is slightly higher than for white women of this age group.

Again, it is conceivable that there is a difference in medical certification between the two groups; but if there is, the corollary evidence would suggest an understatement in the death rate for vascular lesions affecting the central nervous system for the white population, since the death rates for the residual cause groups are larger in the white population than in the Japanese. It may be noted in this connection that the white American has higher death rates for "symptoms, senility, ill-defined conditions" (a cause group into which a fair number of cardiovascular deaths might be classified if certification is poor) than does the Japanese American. However, the death rate for these causes is not high enough in either group to affect seriously the comparisons.

### Japanese in Hawaii and Japan

Some of the characteristics of mortality that distinguish the Japanese population from the white population in the continental United States are paralleled in Hawaii and in Japan (table 3 and figs. 4, 5, 6, and 7). The death rates among Japanese men for diseases of the heart are low in the United States, even lower in Hawaii, and much lower in Japan. For

**Figure 3. Death rates by age and sex for vascular lesions affecting the central nervous system: adult Japanese and white populations of continental United States.**



Japanese women the picture is less neat, but in general it is one of low death rates for this cause. On the other hand, the death rates for vascular lesions affecting the central nervous system are high among the Japanese of either sex in the United States, are slightly higher in Hawaii, and are much higher in Japan. These antithetic differences pretty well balance out for men, so that the death rates for diseases of the cardiovascular system are very similar for Japanese men in the United States, Hawaii, and Japan; in all instances, they are lower than the rates for white men in the United States.

To put the mortality data for Japan in a historical perspective, death rates for vascular lesions affecting the central nervous system, which were at an exceptionally high level between 1918 and 1942, took an abrupt drop after World War II to about the level they had temporarily assumed between 1910 and 1915 (*5*). Thus, in 1951, the year we are using for comparison, the rates were relatively low. Death rates for diseases of the heart, on the other hand, while they have shown some large fluctuations since 1910, with the expected peak in 1918 during the influenza pandemic, have not shown such abrupt changes as have the rates for vascular lesions affecting the central nervous system and have evidenced little long-term trend. If anything, there has been a slight tendency for the death rates for diseases of the heart in Japan to decline over the years.

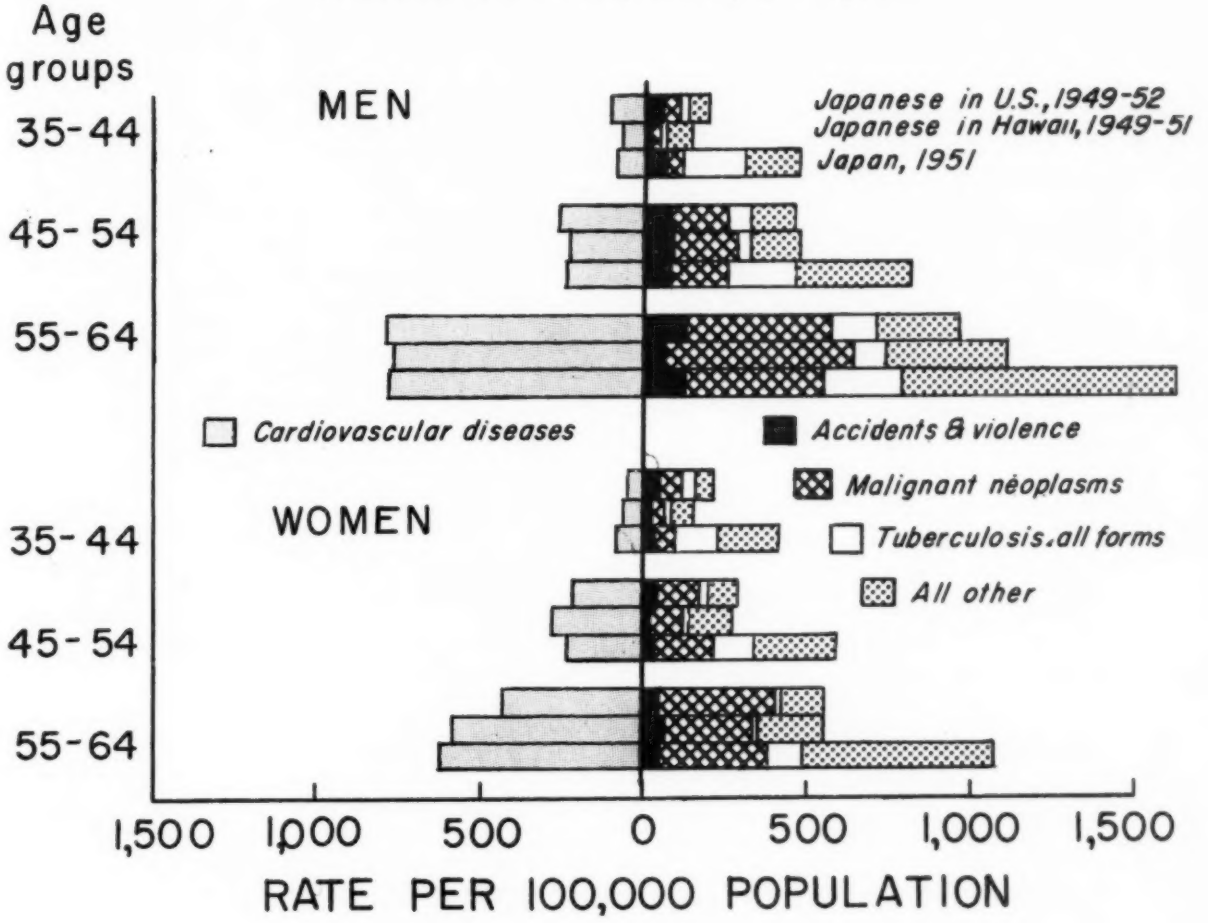
Total mortality in Japan itself tends to be rather high. This is due, in part, to the very high death rate for tuberculosis in Japan, a rate which may be regarded as an exaggeration of the high rates for the Japanese in the United States and in Hawaii. To a larger degree, however, the high total mortality in Japan is due to high death rates for some causes that exhibit relatively low death rates among the Japanese in Hawaii and in the United States, in particular to a high mortality from influ-

**Table 3. Average death rates [1] for selected causes by sex for specified age groups: Japanese in Hawaii, 1949–1951**

| Cause of death [2] | Males, by age group [3] | | | | Females, by age group [4] | | | |
|---|---|---|---|---|---|---|---|---|
| | 35–44 | 45–54 | 55–64 | 65–74 | 35–44 | 45–54 | 55–64 | 65–74 |
| All causes | 199. 3 | 695. 8 | 1, 890. 1 | 3, 987. 5 | 213. 1 | 535. 2 | 1, 126. 4 | 3, 020. 9 |
| Tuberculosis, all forms (001–019) | 15. 8 | 49. 3 | 106. 0 | 133. 7 | 3. 5 | 23. 5 | 25. 2 | 46. 1 |
| Infective and parasitic diseases (020–138) | 3. 2 | 0 | 29. 4 | 59. 4 | 0 | 23. 5 | 0 | 11. 5 |
| Malignant neoplasms (140–205) | 28. 5 | 177. 6 | 571. 2 | 1, 113. 8 | 55. 9 | 93. 9 | 258. 0 | 611. 1 |
| Diabetes mellitus (260) | 6. 3 | 14. 8 | 29. 4 | 96. 5 | 0 | 14. 1 | 56. 6 | 207. 5 |
| Vascular lesions affecting CNS (330–334) | 12. 7 | 64. 2 | 300. 3 | 653. 4 | 21. 0 | 122. 1 | 220. 3 | 576. 5 |
| Diseases of heart (410–443) | 47. 5 | 157. 9 | 471. 1 | 1, 240. 1 | 31. 4 | 145. 5 | 358. 7 | 1, 118. 4 |
| Chronic rheumatic heart disease (410–416) | 6. 3 | 9. 9 | 5. 9 | 14. 9 | 10. 5 | 14. 1 | 25. 2 | 23. 1 |
| Arteriosclerotic and degenerative heart disease (420–422) | 31. 6 | 88. 8 | 300. 3 | 802. 0 | 3. 5 | 46. 9 | 144. 7 | 576. 5 |
| Other diseases of heart (430–434) | 0 | 0 | 0 | 7. 4 | 0 | 9. 4 | 6. 3 | 23. 1 |
| Hypertension with heart disease (440–443) | 9. 5 | 59. 2 | 164. 9 | 415. 8 | 17. 5 | 75. 1 | 182. 5 | 495. 8 |
| Hypertension without mention of heart (444–447) | 0 | 4. 9 | 11. 8 | 37. 1 | 10. 5 | 4. 7 | 6. 3 | 23. 1 |
| Influenza and pneumonia (480–493) | 0 | 4. 9 | 11. 8 | 89. 1 | 0 | 4. 7 | 6. 3 | 46. 1 |
| Bronchitis (500–502) | 0 | 0 | 0 | 7. 4 | 0 | 0 | 0 | 0 |
| Ulcer of stomach and duodenum (540, 541) | 6. 3 | 19. 7 | 17. 7 | 52. 0 | 0 | 0 | 6. 3 | 0 |
| Gastritis, etc. (543, 571, 572) | 0 | 0 | 0 | 14. 9 | 3. 5 | 9. 4 | 0 | 11. 5 |
| Cirrhosis of liver (581) | 6. 3 | 9. 9 | 58. 9 | 37. 1 | 3. 5 | 4. 7 | 6. 3 | 34. 6 |
| Nephritis and nephrosis (590–594) | 9. 5 | 39. 5 | 94. 2 | 52. 0 | 34. 9 | 37. 6 | 50. 3 | 57. 7 |
| Symptoms, senility, and ill-defined conditions (780–795) | 3. 2 | 4. 9 | 11. 8 | 29. 7 | 3. 5 | 0 | 0 | 23. 1 |
| Accidents and violence (E810–E999) | 28. 5 | 98. 7 | 70. 7 | 155. 9 | 14. 0 | 18. 8 | 62. 9 | 69. 2 |
| All other | 31. 6 | 49. 3 | 106. 0 | 215. 3 | 31. 4 | 32. 9 | 69. 2 | 184. 5 |

[1] Rates per 100,000 population in each specified group as of April 1, 1950.
[2] Numbers after causes are category numbers of the sixth revision of the International Lists, 1948.
[3] Total numbers of deaths for specified age groups were: 63, 141, 321, 537.
[4] Total numbers of deaths for specified age groups were: 61, 114, 179, 262.

**Figure 4. Death rates by age and sex for major components of mortality: adult Japanese in continental United States, Hawaii, and Japan.**



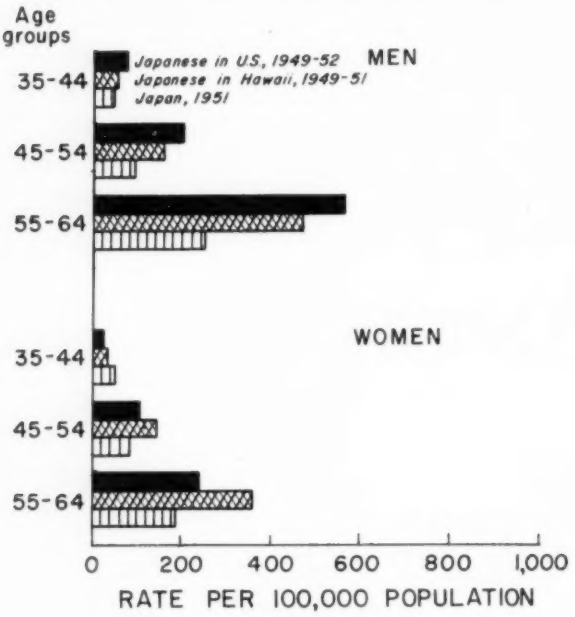

enza and pneumonia, bronchitis, cirrhosis of the liver, and nephritis and nephrosis. There are, in short, a number of diseases tending to raise mortality among adults to a higher level in Japan than in the United States or in Hawaii. Nevertheless, the total death rates for men 45–54 and 55–64, unlike the death rates for men 35–44 or 65–74 and unlike the death rates for adult women at any age, are nearly as high in the white population of the United States as in Japan. This presumably reflects the unusual hazard from heart disease encountered by the white, male, middle-aged American.

It ought to be noted at this point that a relatively few areas in Japan supplied the bulk of the migrants to Hawaii and to the United States. Exact data on this subject are not available, but it appears that the main sources of migration, notably Hiroshima prefecture, were the same for Hawaii and for the United States. (This conclusion is based on personal communications from the Japanese consulate general of Hawaii, the Japanese American Citizens League, and Professor Andrew W. Lind, University of Hawaii.) While detailed mortality was not examined for the Japanese prefectures, the prefectures that are reputed to have supplied the largest number of immigrants to the United States and Hawaii differed little from Japan as a whole either in crude death rates or in total death rates for the cardiovascular causes.

### Nativity

Insofar as cardiovascular mortality among the Japanese of the United States expresses a cultural difference, the death rate from diseases

**Figure 5. Death rates by age and sex for diseases of the heart: adult Japanese in continental United States, Hawaii, and Japan.**




of the cardiovascular system should probably be lower among the foreign-born than among the nisei. Deaths for the Japanese have not been tabulated by nativity, so this possibility cannot be examined directly. An indirect approach is available, however, because of the character of Japanese immigration to the United States. The period of free immigration to the United States was brought to a close in 1911, when the Japanese Government agreed to restrict immigration to the United States and its Territories. (All Asian immigration was stopped in 1924 by an act of Congress and, while Japanese immigration has recently been resumed, it is under very small quotas.)

The effect of this can be seen from the 1950 census data, which give the following percentages of foreign-born Japanese:

| | *Age* | | | |
|---|---|---|---|---|
| | *25–34* | *35–44* | *45–54* | *55–64* |
| United States | 3.2 | 20.1 | 85.8 | 94.7 |
| Hawaii | 1.2 | 7.3 | 59.0 | 93.7 |

Thus, one would expect the Japanese population of the United States aged 45–54 to shift from a preponderantly foreign-born one in 1950 to a preponderantly native-born one in 1960. If this is accompanied by a large rise in cardiovascular mortality for Japanese men in this age group, and especially by a marked increase in the death rate for diseases of the heart, the inclination will be to attribute the present differentials to cultural factors. If a rise does not occur, it will be much more difficult to reach any kind of conclusion concerning the present differentials. Unfortunately, it is impossible to predict the picture for 1960 even from mortality data for the years since 1952.

## Discussion

One interesting feature of these data is the tendency for the Japanese in Hawaii, especially the men, to exhibit an intermediate position with respect to cardiovascular mortality between the Japanese of the United States and Japan. This is true both for diseases of the heart, with the low death rate for the Japanese more marked in Hawaii than in the United States, and for vascular lesions affecting the central nervous system, with higher death rates in Hawaii than in the United States.

The Japanese of Hawaii are apparently closer to the Japanese of Japan than are the Japanese of the United States in something more than a

**Figure 6. Death rates by age and sex for vascular lesions affecting the central nervous system: adult Japanese in continental United States, Hawaii, and Japan.**

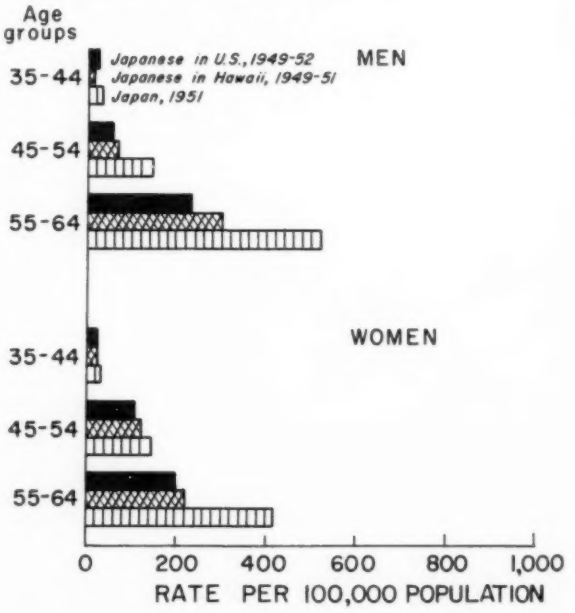
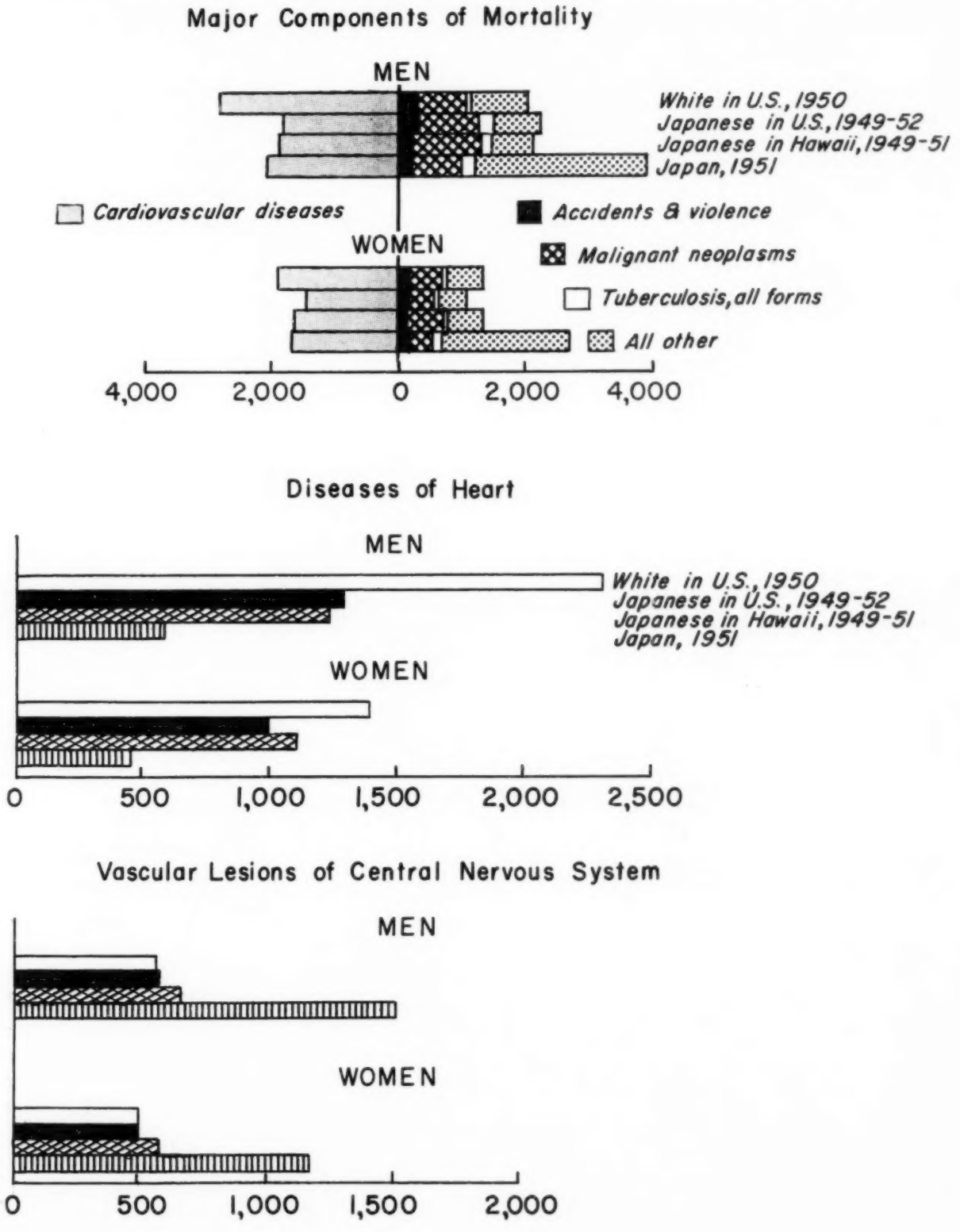


Figure 7. Death rates for major components of mortality for age group 65–74 years: white and Japanese populations of continental United States, Japanese of Hawaii, and Japan.



geographic sense. It is almost as if some historical process were expressing itself in spatial terms, a common enough phenomenon in the evolution of both cultural and biological forms. It is possible that the changes from Japan to Hawaii to the United States in mortality from diseases of the heart and from vascular lesions affecting the central nervous system represent a parallel to the historic changes in mortality that have apparently taken place within the United States during the 20th century.

Perhaps the most notable characteristic of Japanese mortality is the association of a low death rate for diseases of the heart with a high death rate for vascular lesions affecting the central nervous system. This is not unknown in other mortality statistics; in particular, it is one of the most noteworthy differentials between many of the States of the United States. The first instinct of experts in vital statistics is to appeal to a difference in medical certification in such a case, the classic "reporting artifact." This is a possibility, of course, but against it must be weighed the frequency with which a "stroke" can be recognized and described quite unequivocally. It is difficult to see how, in such instances, a death from a cerebrovascular accident could be confused with a death, especially a sudden death, from coronary artery disease.

This is not to read out the possibility of confusing deaths from the two causes, especially when there has not been a physician in attendance during the illness or at death. In some instances cerebrovascular accidents or symptomatology may occur in the terminal stage of heart disease. Such deaths should be classified to diseases of the heart, but if the preexisting heart disease were unknown or overlooked by the physician, they would be classified to vascular lesions affecting the central nervous system. However, in 1940, the last year for which such data have been compiled, only 7.9 percent of all deaths certified to diseases of the heart in the United States had as an associated cause mentioned on the death certificate "intracranial lesions of vascular origin." This is a minor quantity in relation to the differences between the Japanese of Japan and the white American (or, for that matter, between Japanese American and white American men in the age groups between 45 and 74) with respect to mortality from either vascular lesions affecting the central nervous system or diseases of the heart. Even if it were assumed that all deaths with cerebrovascular symptomatology in the terminal stage were classified to vascular lesions affecting the central nervous system for the Japanese, the order of magnitude suggested by the 1940 data on associated causes would account for only a small part of the reported difference between white American and Japanese mortality experience.

On the other hand, if we accept as a fact that the Japanese have higher mortality from vascular lesions of the central nervous system and lower mortality from diseases of the heart than does the white population of the United States, we are faced with a serious medical puzzle. The present consensus seems to be that atherosclerosis is an important factor in both diseases. What mechanism would diminish the effect of atherosclerosis on the coronary artery while increasing its effect on the cerebrovascular system? It might be postulated that hypertension, not atherosclerosis, is the differential factor here, on the assumption that hypertension, as such, is more likely to lead to vascular lesions affecting the central nervous system than to heart disease. (Hypertension, with or without atherosclerosis, is considered by some authorities to be the major cause of vascular lesions affecting the central nervous system, whereas the role of hypertension in heart disease is generally considered less important than the atherosclerotic process.) There is, however, nothing in the mortality data for the hypertensive diseases to support the assumption that hypertension is more common among the Japanese of the United States or Hawaii than among white Americans.

Whatever the explanation advanced, it must account for a lower mortality from heart diseases in association with a higher mortality from cerebrovascular accidents. Present research in the cardiovascular diseases, on the other hand, strongly implies that the causes raising mortality from diseases of the heart, whether atherosclerotic or hypertensive, should also raise mortality from vascular lesions affecting the central nervous system. Clearly, then,

reconciling the mortality data with the medical research data is a major problem for the future.


## Summary

In comparison with the death rates among the white population of the United States (1950), the death rates among the Japanese in the United States (1949–52) and in Hawaii (1949–51) are low. Death rates in Japan, however, tend to be higher than those for the white population of the United States.

Death rates for diseases of the heart are quite low among the Japanese, especially the men, in comparison with those for white Americans, whereas rates for vascular lesions affecting the central nervous system are high. For both cause categories, the Japanese of Hawaii tend to occupy an intermediate position between the Japanese of the United States and Japan. The association of a low death rate for diseases of the heart with a high death rate for vascular lesions affecting the central nervous system raises some interesting questions.


### DOCUMENTATION NOTE

A tabulation of total deaths and average death rates by age and sex for 64 selected causes among the Japanese population of continental United States, 1949–52, has been deposited as document No. 5203 with the American Documentation Institute, Photoduplication Service, Library of Congress, Washington 25, D. C. A photoprint copy may be obtained by remitting $1.25; a 35-mm. microfilm copy by remitting $1.25. Advance payment is required. Make check or money order payable to Chief, Photoduplication Service, Library of Congress.

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## Institute in Social Gerontology

The University of Michigan has recently received a grant of $203,940 from the National Institutes of Health, Public Health Service, to set up a Training Institute in Social Gerontology. Seventeen universities are cooperating in the project; they are California, Chicago, Connecticut, Cornell, Duke, Florida, Harvard, Illinois, Iowa, Michigan, Minnesota, Pennsylvania State, Pittsburgh, Purdue, Syracuse, Washington (St. Louis), and Wisconsin.

As the first activity, publications will summarize all that is currently known about personal and social problems of human aging. The second phase involves a 1-month training seminar for about 40 faculty members selected by the Inter-University Council from applications submitted through universities and colleges.

# Venereal Disease Research Laboratory Field Consultation Services

GENEVIEVE W. STOUT, M.A., AD HARRIS, and ALWILDA L. WALLACE, M.S.

ONE of the objectives of the program of the Venereal Disease Research Laboratory of the Public Health Service for the improvement of syphilis serology in the United States has been to enable State health department laboratories to guide and assist local laboratories. The State laboratory can serve effectively as a reference laboratory and training center only if the quality of its serologic testing is excellent. Periodic technical reviews are valuable aids in helping the State laboratory establish and maintain a satisfactory testing service and standardization program.

In 1951, the Venereal Disease Research Laboratory expanded its field consultation services. During fiscal years 1952–56, activities included consultative visits to State health department laboratories for the purpose of reviewing their serology activities and control programs, furnishing assistance to these laboratories for field refresher training courses or workshops in syphilis serology, and inspection of the serologic testing activities of Public Health Service hospital and clinic facilities.

During fiscal years 1952 and 1953, consultative, or laboratory inspection, visits were part of a program review monitored by the Communicable Disease Center of the Public Health Service, wherein selected areas of laboratory activity were reviewed cooperatively by the Venereal Disease Research Laboratory and the Communicable Disease Center.

In fiscal years 1954–56, laboratory inspection visits were made only at the request and invitation of the State health officer or State laboratory director. Within a short time after each visit, the consultant sent a written report of observations, commendations, and recommendations for change, if any, to the State laboratory director, the State health officer, and the Public Health Service regional medical director.

During 1952–56, the period covered by this report, inspection reviews of central health department laboratories were made in 46 States, the District of Columbia, Alaska, Puerto Rico, and the Virgin Islands. Twelve laboratories were reviewed once; 23, twice; and 15, three times. Since December 1954 visits have been made to the laboratories of 24 Public Health Service hospitals and clinics which perform serologic tests for syphilis.

During the period 1952–56, assistance was given to 27 State health departments in conducting 61 field refresher training courses. Twenty States or Territories were visited once; 5, twice; and 2, three times. Approximately 2,000 technical workers, representing 1,000 laboratories, attended these refresher training courses. For practical reasons, technical reviews and field refresher training courses in the same State are frequently combined, and visits are made to the Public Health Service activities in the same area.

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### Consultative Visits

Consultative visits pursue the following course: Observations are made of physical quarters and working conditions; equipment and glassware; handling of specimens, reports, and records in relation to the test load and the routine sequence of testing; cleaning of glassware; methods of controlling antigens and test reagents; test performance of each procedure for the examination of blood and spinal fluid; established test controls; and the standardization or control program—training, laboratory inspection, interlaboratory evaluation studies, and so on—extended to other laboratories in the State.

The practical aspects of each situation form the bases for suggestions for change or improvement. If test results are not predictably reliable because of some condition or practice in the laboratory, this is pointed out by the consultant. For example, certain serologic tests for syphilis must be performed at room temperatures between 73° and 85° F. in order to obtain valid results. If the temperature in the laboratory is higher or lower than this during certain seasons of the year, the consultant may recommend that air-conditioning or an adequate heating system be installed.

If incorrect test results are being reported because bacterially contaminated spinal fluids are being tested, the consultant suggests that grossly contaminated spinal fluids not be tested but that they be reported as "unsatisfactory for testing." He also explains the preparation and use of tubes containing merthiolate to prevent bacterial contamination of spinal fluid.

Results of tests performed by the visited laboratory on VDRL dehydrated control serums, which have an established reactivity pattern, offer the consultant an immediate check on reactivity levels. Significant differences between the laboratory's test results and the established pattern of the control serums can usually be resolved on the basis of test mechanics, antigens, reading levels, or glassware by actual comparative testing during inspection. Discrepancies in test results are sometimes due to outdated techniques or to the use of an antigen prepared by an old technique or formula.

Practical on-the-job training of laboratory personnel is undertaken when the laboratory director so desires and when time is available. The purpose of this training may be improvement of the technical performance of tests in current use or the demonstration of new techniques and methods, or both. Sometimes changing to a different method of testing offers advantages under the particular circumstances in a laboratory. For example, if the laboratory performs a large number of quantitative tests daily, the consultant may recommend changing from a tube testing procedure to one of the slide quantitative procedures that will result in a lighter workload without sacrificing accuracy of results.

All on-the-job training and recommendations pertaining to testing procedures adhere strictly to the directions given in the 1955 Manual of Serologic Tests for Syphilis (*1*). This manual contains general information on testing procedures and specific techniques for each of the serologic tests for syphilis most widely used in America. The manual was compiled by the Venereal Disease Research Laboratory in cooperation with the author-serologists and is available to all laboratories in the country.

Venereal Disease Research Laboratory consultants frequently suggest that one or more of the serologists from a State health department laboratory attend a refresher training course in syphilis serology at the Venereal Disease Research Laboratory. This does not necessarily mean that the State laboratory's current test performance is poor. More often it indicates that a serologist shows promise and that the laboratory would benefit by the additional training he would receive. For example, the serologist may perform the tests in current use in the State laboratory satisfactorily but may not have had experience with any other test procedure. By attending a refresher course, he may gain a working knowledge of other tests that he can use in local laboratories in his State and in providing training in these techniques and in evaluating the performance of these tests when visiting laboratories. Or the consultant may feel that the statewide standardization program could be improved by the use of a better designed evaluation study. If so, he recommends that the State serologists attend a course in management and control of

syphilis given by the regional laboratory at the Venereal Disease Research Laboratory.

During consultative visits, the program of the State laboratory for the improvement and standardization of syphilis serology within the State is critically reviewed. Ideally, these State programs include an intrastate serology evaluation study, consultative visits to participating laboratories, and provision for training in syphilis serology. Some States offer additional services such as the distribution of standardized antigens, reagents, and controls. Each part of the program is reviewed in detail and its practical aspects are considered, as well as the limitations imposed by the funds and personnel available to the State laboratory for these additional services and the number and geographic distribution of laboratories within the State.

When an inspection visit is completed, the consultant reviews all recommendations with the director of the State health department laboratory and, unless the director objects, with the senior serologists. He also discusses a summary of the findings and general recommendations with the State health officer in the presence of the State laboratory director. Finally, the consultant submits to the State health officer and the regional medical director a written report of his observations, listing the commendable features of the existing program of the laboratory and suggesting ways of improving the weak features.

### Field Refresher Courses

During the past 5 years, representatives from the Venereal Disease Research Laboratory have conducted or assisted with 61 field refresher courses in 27 States. These courses are presented as a function of the State health department laboratory program, and the position of the Venereal Disease Research Laboratory representative is clearly defined to the participants as that of a consultant to or member of the State laboratory team. The director of the State laboratory and key personnel from the serology section take an active part in the courses. Serologists from the State laboratory usually take part in the test presentations and perform the demonstrations.

One objective of the Public Health Service consultant is to assist in defining the position of the State laboratory as a reference and training center for other laboratories in the State. He draws attention to the laboratory practices of the State laboratory and refers to services that are available to local laboratories. If the State has a laboratory-approval program, time is usually allowed in the schedule for describing this program and for questions and discussion. The protocol for the State evaluation survey in syphilis serology and the method used for analyzing results are usually discussed, since they are of general interest.

Field refresher courses in syphilis serology are in two general categories: (*a*) a lecture demonstration, in which each test is discussed, the technique demonstrated, and the technologists given an opportunity to observe completed tests and make comparative readings; and (*b*) a participation-type workshop with the same presentation method, followed by actual test performance by the registrants under supervision.

In States which have a well-established standardization program in syphilis serology, the lecture-demonstration type of course is used to illustrate the correct method of performing tests in current use, to stimulate interest in new test procedures, to emphasize the precautions and controls that are essential for obtaining reliable test results, and to suggest further practical training and experience that may be obtained in the State laboratory. The participation-type course, using the "workshop" approach, has been preferable when the State does not have a standardization program or is in the process of initiating one.

When further basic instruction of local laboratory workers is needed, the State laboratory personnel can be indoctrinated into the techniques of practical training and supervision by assisting with preparations, demonstrations, and instruction. In several instances the lecture-demonstration part of the course has been followed by a half-day period during which the participants actually performed the tests of their choice under supervision of the State and consultant serologists. In one instance, this workshop type of refresher course served as orientation for State laboratory personnel who

later conducted a series of workshops at other places within the State.

There has been no single pattern for the field refresher training courses in serology since it has been necessary to design courses to meet the particular needs of each State. The consultant from the Venereal Disease Research Laboratory and the State laboratory director or senior serologists, or both, formulate a plan for these courses by means of a conference or, more frequently, by correspondence. Final organization, promotion, and publicity are the responsibility of the State laboratory.

The State health department laboratory sponsors the field refresher training course but may ask other groups, such as clinical pathologist and technologist organizations or a university, to act as co-sponsors. By discussing plans with these groups and securing their cooperation, valuable assistance is frequently obtained in the promotion of the training courses within these organizations and in encouraging technologists under their direction to attend. The content of a training course is usually determined by the tests in local use and those that the State health department wishes to advance.

Program plans differ according to the number and kinds of tests to be demonstrated and the manner of their presentation. Training courses have varied in length from 1 to 5 days. In some States, a single course has been given in the city where the State public health laboratory is located. In other States, courses have been held at several different places in order that technologists from more laboratories might attend. As many as eight courses have been conducted in a State during the visit of a consultant. Courses are scheduled to meet the convenience of the local laboratories and are frequently held in the evening or on weekends. This practice has more than doubled attendance in some instances.

In one State, a series of courses has been held in different areas at yearly intervals. In another State, courses were held in 3 successive years. The first year, formal refresher courses were held in the two largest cities in the State. The second year, a series of 4 practical "benchwork" courses were held on 4 successive Saturdays in the State health department laboratory. The third year, a serology conference was held to discuss changes in the new Manual of Serologic Tests for Syphilis (*1*), the development of tests using treponemal antigens, and a problem clinic. In this way, training courses in syphilis serology were integrated into a continuous, progressive, training program.

The need for repetition of refresher courses in serology is determined by the new material to be presented and the turnover in personnel in local laboratories. During the past 5 years there have been many changes in the routine tests used for syphilis serology, with a shift from tests using lipoidal antigens to those using cardiolipin antigens. The turnover in personnel in local laboratories in many States is continuous and fairly rapid.

## PHS Laboratories

Since December 1954, the program for standardization of serologic tests for syphilis in the laboratories of Public Health Service hospitals and clinics has included consultative visits by Venereal Disease Research Laboratory representatives to the 24 facilities in which these tests were being performed. In most of these laboratories, on-the-job training, in addition to a technical review of test performance, was accomplished during the visit. On-the-job training was especially indicated on the first visits because of changes in the official serologic testing methods. Many of the laboratories needed assistance in preparing orders for equipment and in training technicians in the newly prescribed test techniques.

Because laboratories in Public Health Service hospitals and clinics receive antigens and other serologic reagents from the Venereal Disease Research Laboratory, and because an evaluation study has been established to determine the proficiency with which the serologic tests for syphilis are being performed at these laboratories, future inspection visits and on-the-job training will be facilitated and expedited.

## Discussion

In general, the objectives of technical and program reviews of State health department

laboratories by consultants from the Venereal Disease Research Laboratory have been to commend the outstanding good features of the activities and program in syphilis serology and to offer constructive suggestions for improving weak features. Particular attention has been paid to intrastate programs for standardization of test performance since the development of these programs is an essential part of the national program. Any comprehensive plan for improvement in syphilis serology must include consideration of test performance in the local laboratory since the State laboratory usually performs only a fraction of the total tests for syphilis performed in a State.

Because the problems encountered by State health department laboratories may arise from differences in geographic locations, working conditions, and budgetary limitations, recommendations for change must be tailormade for each laboratory. Some laboratory directors have used the recommendations of consultants regarding adequacy of laboratory facilities, equipment, glassware, air-conditioning, and personnel in preparing budget requests. For the most part, consultants' suggestions have been well received by the laboratories. Most of the recommendations made during these visits are accepted and further suggestions are usually welcomed.

In the past 5 years, with the adoption of newer and simpler testing techniques in syphilis serology, there has been a marked change in routine testing operations. The training of serologists accomplished during visits of Venereal Disease Research Laboratory consultants to their laboratories has been valuable in this transition period.

Field refresher training courses in syphilis serology have enabled State health department laboratories to increase their accomplishments in this essential phase of State standardization programs in syphilis serology. As a part of the State programs, these refresher courses or workshops have had the following results:

1. Performance of serologic tests for syphilis has improved.
2. Modern testing methods with cardiolipin antigens have been generally adopted.
3. The position of the State health department laboratory as a reference laboratory and training center has been emphasized and a closer working relationship with local laboratories has developed.

Indirectly, the field refresher training courses have also been utilized in training medical technologists and public health laboratory workers in universities, colleges, and hospitals. Instructors from teaching institutions frequently attend these field courses. In several instances, they have requested and received additional training in courses at the Venereal Disease Research Laboratory. In one State, a workshop in syphilis serology was recently conducted for college and university instructors in clinical laboratory technology and public health bacteriology.

Consultative visits to State public health laboratories integrate the activities of the Public Health Service Venereal Disease Research Laboratory with these State laboratories. The program of the Venereal Disease Research Laboratory for the improvement and standardization of syphilis serology has been applied by many State laboratories. The State and Territorial health department laboratories are continually improving and modernizing their own testing operations and, by working with local laboratories, have helped the local laboratories to attain dependable performance of serologic tests for syphilis.

## Summary

The field consultation services of the Venereal Disease Research Laboratory of the Public Health Service during a 5-year period which includes the fiscal year 1956 have included reviewing the syphilis serology activities and programs of the State health department laboratories, assisting States in field refresher training courses or workshops in syphilis serology, and inspecting serologic testing in Public Health Service hospital and clinic facilities. Utilizing such services has aided State health department laboratories to develop statewide programs for the standardization and control of syphilis serology.

## REFERENCE

(1) Public Health Service: Serologic tests for syphilis. 1955 manual. PHS Pub. No. 411. Washington, D. C., U. S. Government Printing Office, 1955.

**STATEMENT**

*by the U. S. National Committee on Vital Health and Statistics*

# National Vital Statistics Needs

THE U. S. National Committee on Vital and Health Statistics was requested by the Public Health Service to make a comprehensive study of the objectives and the program of national vital statistics, to report its findings, and to make recommendations with regard to the future development of the program. It was asked, also, to undertake a special study of the needs for marriage statistics and the extent to which existing data satisfy them.

The committee's findings and recommendations are based on:

1. An extensive questionnaire survey of the principal users of the various kinds of vital statistics and a special questionnaire survey of the major users of marriage statistics.

2. Participation in a panel discussion at a meeting of the American Association of Registration Executives on the subject "A National System of Vital Statistics."

3. Intensive studies of particular phases of the problem.

4. Frequent, long discussion meetings of the subcommittees.

In the detailed report (*1*), the committee has examined the major areas of responsibility of NOVS and has outlined the goals to be achieved in each area. This is followed by a statement of the principal deficiencies in the present system with respect to these goals and finally by the recommendations.

## The Role of NOVS

In this country, the registration of vital events is the responsibility of the States. Each State also has the responsibility for tabulating and publishing its own data so as to meet its special needs. The tabulation and publication of national data on births, deaths, notifiable diseases, marriages, divorces, and annulments are the functions of the National Office of Vital Statistics, a branch of the Division of General Health Services, Bureau of State Services, Public Health Service.

The functions of NOVS should not be regarded as confined to the routine processing and publication of historic series of data. The justification for publishing data is that they serve some useful purpose. Vital statistics are essential for administrative purposes in both business and government and for research. Used in conjunction with population data, they provide a background (*a*) for public health programs and medical research, (*b*) for making projections of the size and composition of the

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*This report was prepared by the Subcommittee on National Vital Statistics Needs: chairman, William G. Cochran, Johns Hopkins University; Harold F. Dorn, Public Health Service; Forrest E. Linder, United Nations; O. K. Sagen, Illinois State Department of Public Health; Mortimer Spiegelman, Metropolitan Life Insurance Co.; P. K. Whelpton, Scripps Foundation for Research in Population Problems, Miami University; Robert F. Lenhart, Committee for Economic Development, Washington, D. C.*

*A special study of national marriage statistics, the results of which are incorporated in this report, was conducted by the Subcommittee on Utilization of Marriage Statistics: chairman, Conrad Taeuber, Bureau of the Census; Myron S. Silbert, Federated Department Stores, Inc.; Clifford Kirkpatrick, University of Indiana; Ann Dillon, Tennessee State Department of Public Health; Louis Weiner, Board of Governors of Federal Reserve System; Charles B. Reeder, E. I. Dupont De Nemours and Co.*

population, and (*c*) for the study of trends regarding family formation, composition and dissolution, and other aspects of our society. NOVS has major responsibilities both for making available the kind of data that will be most useful in these areas and for stimulating widespread and fruitful application of these data. These responsibilities call for foresight and flexibility to meet changing needs. Further, although many of the uses of vital statistics lie in the field of public health, the data also have important applications to demography.

The fact that NOVS is a part of the Public Health Service insures full recognition of the health interests in vital statistics. This implies an obligation and responsibility to maintain a national vital statistics program that is not overshadowed by health interests but also meets the justifiable needs in the demographic and other areas of interest.

### Major Recommendations and Observations

The committee wishes to draw particular attention to the following recommendations which appear to deserve the highest priority:

Immediate priority should be given to the processing and procurement of data so as to achieve a schedule of processing which permits the release for printing of final data within 15 months after the close of the data year, and this schedule should be maintained or improved upon in the future.

Statistical studies that contribute to knowledge in public health, fertility, marriage, divorce, and mortality should be developed as part of the regular program of NOVS. In particular, attention should be given to the influence of population characteristics, such as sex, age, marital status, and occupation. The program should include collection of new data and development of new methods of analysis that are needed for program planning, administration, and research.

NOVS should be given sufficient fiscal resources to provide more adequate technical services to the States in the following areas: professional advisory and consultant service on technical and management problems; expanded information and clearinghouse services on technical subjects and methodology; educational programs directed toward improvement of source data; national program for recruiting and training professional vital statistics personnel; and work with State health department program divisions in promoting effective utilization of vital statistics data.

The committee has also examined two alternative methods of producing national vital statistics, in particular the use of data pretabulated by the States and of punchcards supplied by the States. Recommendations with regard to these alternatives are as follows:

1. NOVS should reject any data procurement method that limits or restricts the use of vital statistics records for research or that prevents it from controlling the quality of national vital statistics tabulations. Specifically, NOVS should procure transcripts of the individual vital records for processing.

2. NOVS should reject the proposal to produce national vital statistics from data pretabulated by the States because: (*a*) the available national data would shrink to those obtainable from a minimum rigid list of tabulations; (*b*) it would become very difficult to make national studies based upon information obtainable only from transcripts of the individul records or from individual punchcards; (*c*) it would add to the cost of State operations without a compensatory decrease in the cost to NOVS.

3. NOVS should reject the punchcard method of collecting vital statistics data as a general method applicable to all States because: (*a*) it restricts the freedom of action both of the State offices of vital statistics and of NOVS, thus making vital statistics less useful rather than more useful; (*b*) effective leadership in national and international vital statistics will be sacrificed because of the loss of technical skills and knowledge in NOVS; (*c*) the scope and detail of national vital statistics cannot be greater than those of the participating State ranking lowest in these respects; (*d*) the possible savings in cost are outweighed by the disadvantages of the method; (*e*) the overlapping of State and Federal vital statistics procedures, tabulations, and needs is not great enough to make this method possible without serious disadvantages to both parties.

4. NOVS should abandon any further experimentation with the punchcard method in the

collection of mortality statistics and, if the use of this method to collect birth statistics is continued at all, should limit it to the few States where it can be shown to be mutually advantageous and where it will not adversely affect the scope, quality, continuity, and usefulness of national vital statistics.

5. NOVS should continue to cooperate with the States in studies of ways to improve the division of labor in the national vital statistics system. Changes in the system should be made only after full consideration of: (*a*) the basic requirements for national vital statistics; (*b*) safeguards for the continuity of operation; (*c*) opportunities to improve the final product and to render maximum services.

The committee also notes that marriage and divorce (including annulment) statistics are in a highly unsatisfactory state as regards geographic coverage, uniformity of reporting, accuracy, and amount of detail. A program for the improvement of these data should be consistent with the above recommendations and receive the same level of priority, but it is recognized that it is not possible to carry out such a program under the present budgetary position. The committee recommends that:

1. NOVS work actively to establish a marriage registration area through implementation of the four criteria established for admission to the area, and to extend it until every State is included. These criteria are: (*a*) central record files for marriages in the State office containing items on standard record of marriage form; (*b*) adoption of report form of marriage containing the items on the standard record of marriage form; (*c*) reporting by all local areas regularly to the State office; (*d*) agreement between State office and National Office of Vital Statistics on joint testing of reporting for completeness and accuracy.

2. Methods of collecting marriage statistics be explored with a view to assuring (*a*) complete coverage of the United States, (*b*) uniform data both between and within States, (*c*) comparability of time series, and (*d*) accuracy of information.

3. NOVS obtain copies of marriage records from the States and local areas to be processed in the NOVS.

Similar actions are needed for national statistics on divorce and annulment. However, specific recommendations are deferred until a thorough study of this problem can be made.

### Other Recommendations

*Completeness of data:* NOVS should stimulate and assist in special studies of birth registration completeness in areas where completeness of registration is still a problem.

NOVS should endeavor to develop methods for measuring incompleteness of death and late fetal death registration adaptable to those areas where this problem is important. If practical techniques can be found, they should be applied to obtain more information on the extent of incompleteness and on means for attaining more complete reporting.

Efforts toward improvement of notifiable disease reporting should be concentrated first on those diseases that are major health problems and are amenable to control procedures.

NOVS should cooperate with the States in the development and application of tests on the completeness of the reporting of marriages, divorces, and annulments to the central offices, and on the accuracy of the information on the report forms.

*Uniformity of data:* NOVS and the State vital statistics offices should continue their efforts to obtain complete coverage of all items on the standard certificates.

*Scope and detail:* NOVS should keep in closer touch with the users of its data when planning the scope and detail of its tabulations and publications and when making decisions on fundamental issues.

*Explanatory and interpretive text:* The analytical functions of NOVS should be strengthened to make available more explanatory and interpretive material useful to consumers.

*Cyclical schedule of tabulations:* The concept of cyclical collection and tabulation of data should be firmly established as a part of the regular program of NOVS with adequate safeguards in regard to the continuity of the various tabulation cycles.

### Use of Vital Statistics

Questionnaires were sent to 369 persons selected for their presumed interest in some

aspect of vital statistics data; replies were received from 254 of them. Although the committee was aware of the limitations of a questionnaire of this type, information was sought regarding the relative frequency with which various types of vital statistics are used and the different sources from which these data are obtained; the extent to which the respondents regard available vital statistics as adequate for their uses; and, ways of reducing the quantity of material published by NOVS and still meeting the important needs of consumers. The results of the questionnaire may be summarized as follows:

*Frequency of use of types of data:* Mortality and natality statistics are the data issued by the National Office of Vital Statistics which are used most frequently by the persons replying. Next in order of frequency of use are the statistics on marriages and notifiable diseases. The consumers surveyed showed the least interest in fetal death statistics and divorce statistics. This generally corresponds to the requests for data received by NOVS.

*Geographic categories used:* An overwhelming majority of the consumers surveyed indicated use of statistics for the country as a whole and for States. Also, the majority of respondents appear to have need for data on all of the other geographic areas listed.

*Use of State and local publications:* Excluding State registrars of vital statistics, relatively little reference appears to be made to State and local publications. However, this may be due, in part, to the composition of the list of persons and agencies surveyed.

*Secondary references:* Of the secondary references, the Statistical Abstract of the Bureau of the Census is most frequently used, followed by the United Nations Demographic Yearbook and by the World Almanac.

*Unpublished data:* About one-half of the respondents stated that they have requested unpublished data from NOVS.

*Timeliness:* The dissatisfaction expressed most frequently and most strongly concerning NOVS publications related to the lack of timeliness of their issuance. The release of unpublished data to those requesting them appears to have softened the reactions of some of the respondents. Considerable understanding and appreciation of the problems faced by NOVS in the early publication of data were evident, but the general opinion was that the data would be much more useful if they could be issued on a more timely schedule.

*Accuracy:* Most of the respondents did not express any opinion concerning accuracy, except to indicate general satisfaction with the quality of data. Most of the defects mentioned were those that have been already recognized by NOVS, namely, errors in residence allocation of births and deaths, and incompleteness of notifiable disease statistics.

*Scope and detail:* A large proportion of respondents indicated satisfaction with the existing scope and detail of the published data. There were relatively few suggestions for reducing the quantity of data published.

### Use of Marriage Statistics

A second questionnaire devoted exclusively to marriage statistics was sent to 539 persons or agencies to obtain information concerning uses and needs indicated by consumers of marriage statistics. Replies were received from 262, or 49 percent. While one question dealt with potential uses if statistics were available, it is doubtful that the full effect of supply on demand is revealed. Perhaps improved statistics must actually be available in order to call out full expression of demand from consumers.

Since users of marriage statistics were selected as respondents it is to be expected that use would be reported in ways proportionate to the kind of persons included in the mailing list; namely, businessmen, university people, private researchers, and government officials. In the judgment of the committee the mailing list of business users stressed national organizations, and the survey may have failed to reach local users in business fields. Probably, the questionnaire survey was most effective in revealing the varied uses of marriage statistics, in indicating the scope of the desired data, and in eliciting new suggestions.

The four general findings of the survey:

1. There is evidence of extensive use of marriage statistics in large business organizations,

in colleges and universities, in government, and in private research.

2. The returns indicate use by individuals in business organizations for estimating household formation and for predicting demand for consumer goods. Persons in research and academic fields expressed a preference for data useful in sociological and demographic research.

3. With respect to the time-space aspect of statistical reporting, the broader categories were favored. Although there was strong support for monthly totals and for annual national and State reporting of more detailed figures, there seemed to be a relatively limited demand for reporting of the monthly figures in advance of present publications.

4. Strong support was expressed for complete national and State coverage on an annual basis and for more specific data, with cross-tabulations for bride and groom, and information on items not available from registration records.

#### REFERENCE

(1) U. S. National Committee on Vital and Health Statistics, Subcommittee on National Vital Statistics: National vital statistics needs. Vital Statistics—Special Reports, vol. 45, No. 11. U. S. Government Printing Office, 1957.

## CDC Laboratory Refresher Training Courses

Laboratory refresher training courses at the Communicable Disease Center, Chamblee, Ga., will be offered during the period September 1957 through March 1958 according to the following schedule:

Laboratory methods in the diagnosis of parasitic diseases:
- Part 1. Intestinal parasites. September 9–October 4.
- Part 2. Blood parasites. October 7–25.

Laboratory methods in the diagnosis of viral and and rickettsial diseases. October 14–25, March 10–21.

Laboratory methods in the diagnosis of rabies. October 28–November 1, March 24–28.

Laboratory methods in medical mycology—cutaneous, subcutaneous, and systemic fungi. January 6–24.

Laboratory methods in the diagnosis of tuberculosis. January 20–31.

Laboratory methods in the study of pulmonary mycoses. February 3–14.

Laboratory methods in the diagnosis of bacterial diseases:
- Part 1. General bacteriology. February 10–21.
- Part 2. General bacteriology. February 24–March 7.

Laboratory diagnostic methods in veterinary mycology. February 24–28.

Laboratory methods in the diagnosis of bacterial diseases—enteric bacteriology. March 10–21.

Serologic methods in the diagnosis of parasitic and mycotic infections. March 10–21.

By special arrangement the following courses will be offered:
- Laboratory methods in the diagnosis of malaria.
- Special training in virus techniques.
- Typing of *Corynebacterium diphtheriae*.
- Special problems in enteric bacteriology.
- Phage typing of *Salmonella typhosa*.
- Laboratory methods in the diagnosis of leptospirosis.
- Serologic differentiation of streptococci.
- Bacteriophage typing of staphylococci.

Information and application forms should be requested from the Laboratory Branch, Communicable Disease Center, Public Health Service, P. O. Box 185, Chamblee, Ga.

# technical publications

## Film Reference Guide for Medicine and Allied Sciences

*PHS Publication No. 487. June 1956. 51 pages. 45 cents.*

This guide is designed to provide members of the Interdepartmental Committee on Medical Training Aids, as well as film users outside ICMTA member agencies, with a ready reference to selected medical films and to where they may be obtained.

Publication numbers for other ICMTA members are: Air Force, AFP 160–15–1; Army, DA Pamphlet 108–2; Navy, NAV MED P 5042; Veterans Administration, Catalog 7.

Copies can be obtained from the Card Division, Library of Congress, Washington 25, D. C.

## Communicable Disease Center

### Report of activities, 1954–55

*PHS Publication No. 521. 1957. 63 pages; illustrated.*

This report on the major activities of the Communicable Disease Center, Bureau of State Services, Public Health Service, summarizes the accomplishments of CDC's several organizational components during the fiscal year 1955. It is also intended to aid State, local, and other health agencies in planning their programs.

The work reported has been divided into broad categories corresponding to the Center's pattern of operation and reveals the scope, nature, and interrelationships of activities carried on by the combined staff. It covers such areas as epidemic and disaster aid, epidemiological surveillance, field and laboratory investigations of specific diseases and disease vectors, and development of diagnostic procedures. It describes special operational services given the States in the form of consultations, demonstrations, program reviews and laboratory diagnostic and reference services, as well as training programs for laboratory and field work and the production of audiovisual and other aids.

A bibliography of articles published by CDC staff members and their collaborators during late 1954 and 1955 is appended. Titles are arranged according to subject matter so that readers can select articles dealing with their special fields of interest.

## Sanitary Engineering Aspects of the Atomic Energy Industry

*U. S. Atomic Energy Commission Publication No. TID–7517, parts Ia and Ib, October 1956. 957 pages. $3.10.*

This publication, in two parts, contains reports presented at a seminar sponsored by the Atomic Energy Commission and the Public Health Service, held at the Robert A. Taft Engineering Center, Cincinnati, Ohio, December 6–9, 1955.

Part Ia presents technical data from unclassified AEC papers concerned with radioactive waste disposal problems of interest to public health agencies and to sanitary engineers.

Part Ib includes technical data contributed by Public Health Service participants. Public Health Service interests, contributions, activities, and technical and administrative aspects of environmental health problems of the atomic energy industry are considered.

As a whole, the publication presents the advantages, limitations, comparative hazard, and the present most promising approaches to radioactive waste disposal problems attendant on broadening the atomic energy industry into peaceful uses by testing ideas and proposals presented in terms of possible public attitudes. Also discussed is the responsibility of public officials for regulating the industry so that the hazard to the public may remain within acceptable limits, without impeding practical applications of nuclear energy.

Copies are available from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

## Workshops for the Disabled

### A vocational rehabilitation resource

*Office of Vocational Rehabilitation Publication. Rehabilitation Service Series No. 371. 1956. 167 pages. 60 cents.*

Prepared by leading rehabilitation and workshop authorities, this publication is designed to familiarize the reader with the origin and nature of the services afforded by various types of workshops and some of the problems they face.

The bulletin traces some of the developments of different kinds of shops under diverse auspices. It attempts to show how such shops can be resources for many of the services necessary for the vocational rehabilitation of persons having substantial employment handicaps.

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